DOCUMENT RESUME

ED 292 593 RC 016 509

AUTHOR	Wilk, Valerie A.
TITLE	The Occupational Health of Migrant and Seasonal Farmworkers in the United States. Second Edition.
INSTITUTION	Farmworker Justice Fund, Inc., Washington, DC.
SPONS AGENCY	Health Resources and Services Administration, Rockville, MD. Bureau of Health Care Delivery and Assistance.
REPORT NO	ISBN-0-9616508-2-6
PUB DATE	86
NOTE	133p.; For the executive summary, see RC 016 510.
AVAILABLE FROM	National Rural Health Association, 301 East Armour Blvd., Suite 420, Kansas City, MO 64111 ($15.00; $12.00 for quantities).
PUB TYPE	Information Analyses (070)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Agricultural Laborers; Child Welfare; Demography; Disease Incidence; *Diseases; Epidemiology; Farm Labor; Health Conditions; *Health Needs; Labor Legislation; Migrant Health Services; *Migrant Problems; Migrants; *Occupational Diseases; Occupational Safety and Health; Pesticides; Physical Environment; Poisons; Public Health; Quality of Working Life; Research Needs; Rural Population; Sanitary Facilities; Seasonal Laborers; *Work Environment

ABSTRACT

Intended to provide a framework for a research agenda on migrant and seasonal farmworker health and to serve as a resource for all those concerned with farmworker health, this report examines farmworker health data gathered within the past 10-15 years. The document contains the following material: (1) an overview of the major occupational health problems reported by migrant health centers; (2) a summary of the literature on each agricultural health problem presented; (3) information on ongoing research projects on farmworker occupational health; (4) recommendations for research priorities on farmworker health; (5) information on occupational safety and health laws covering agricultural workers; and (6) a resource guide on farmworker occupational safety and health, including training materials. One-third of the report is devoted to specific occupational health problems including communicable diseases, urinary tract infections/kidney problems, heat stress, pesticide-related illness, dermatitis, eye problems, accidents, noninfectious respiratory diseases, cancer, hazards for children in the fields, and hazards for pregnant women and/or the newborn. (JHZ)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
● Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

THE OCCUPATIONAL HEALTH OF MIGRANT AND SEASONAL FARMWORKERS IN THE UNITED STATES

ED292593

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
Valerie A. Wilk
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

RC016509

Farmworker Justice Fund, Inc.

BEST COPY AVAILABLE

OCT 1997
RECEIVED
ERIC/CRESS

THE
OCCUPATIONAL HEALTH
OF
MIGRANT AND SEASONAL FARMWORKERS
IN THE UNITED STATES

SECOND EDITION

THE
OCCUPATIONAL HEALTH
OF
MIGRANT AND SEASONAL FARMWORKERS
IN THE UNITED STATES

SECOND EDITION

Valerie A. Wilk

Farmworker Justice Fund, Inc.
Washington, D.C.

THE OCCUPATIONAL HEALTH OF MIGRANT AND SEASONAL FARMWORKERS IN THE UNITED STATES

Copyright © 1986 by the Farmworker Justice Fund, Inc., 2001 "S" Street, N.W., Suite 312, Washington, D.C. 20009. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the publisher.

Editor: Ann-Therese Carlozzo, Editorial Experts, Inc.
Typesetting and printing: Spangler Printers, Kansas City, Kansas

Production, coordination and distribution:
National Rural Health Care Association (NRHCA)
301 E. Armour Blvd., Suite 420
Kansas City, MO 64111

Design supervisor: Barbara A. Schaaf (NRHCA)

Library of Congress Cataloging-in-Publication Data

Wilk, Valerie A., 1950-
The occupational health of migrant and seasonal farmworkers in the United States.

Includes bibliographies.
1. Migrant agricultural laborers—Diseases and hygiene—United States. I. Title. [DNLM: 1. Agricultural Workers' Diseases—occurrence—United States. 2. Transients and Migrants. WA 400 W681o]
RC965.A5W55 1986b 362.1 86-22857
ISBN 0-9616508-2-6 (pbk.)

Printed in United States.
Cover photos of child and grapefruit picker © 1984 and 1985 by Philip Decker. Photo of pregnant woman by Michael Greenlar, BOCES Geneseo Migrant Center. Used with permission.

Acknowledgments

This report was commissioned by the East Coast Migrant Health Project, Washington, D.C., with funding provided by the Office of Migrant Health, Bureau of Health Care Delivery and Assistance, Public Health Service, U.S. Department of Health and Human Services, Rockville, Maryland.

I want to express my thanks to Sister Cecilia Abhold and Helen Kavanagh of the East Coast Migrant Health Project, Inc., Washington, D.C.; Sonia M. León Reig and Billy Sandlin of the Office of Migrant Health; Charles Horwitz, Maureen Weaver, Beatrice Bobotek, Margara Heilman, Naomi Medvin, and Charles Mitchell of the Migrant Legal Action Program, Inc., Washington, D.C.; and all those administrators, clinicians, and researchers who provided information for this project. Special thanks to Lillian Kula for preparation of the manuscript, Ann-Therese Carlozzo for editing, Barbara A. Schaaf of the National Rural Health Care Association, Kansas City, Missouri, for her invaluable assistance in the publication process, and to the following reviewers for their time and helpful comments: Patricia Bauman of the Milbank Memorial Fund; David Cavenaugh of the National Association of Community Health Centers, Washington, D.C.; Dr. Jorge Chiriboga of the University of Puerto Rico, San Juan; Dr. Molly Coye of the New Jersey Governor's Office, Trenton; Dr. Edward Kissam of E. H. White & Co., San Francisco; Mr. James Laughlin of the Illinois Migrant Council, Chicago; Sister Jeanne Meurer of the Ruskin Migrant and Community Clinic, Inc., Ruskin, Florida; Dr. Jesse Ortiz of the University of Massachusetts at Amherst; Dr. Charles Smith and Ms. Linda Smith of the University of North Carolina, Chapel Hill; Mr. Paul Varney of the Manatee County Rural Health Services Inc., Parrish, Florida; and Dr. Willis Wingert of the Los Angeles County-University of Southern California Medical Center, Los Angeles.

Valerie A. Wilk
Washington, D.C.
February, 1986

Table Of Contents

Page No.

I. Executive Summary ... 1

II. Recommendations ... 4

III. Purpose of this Report ... 10

IV. Farmworker Demographics ... 11

V. A Review of Recent Data on the Health Status of Farmworkers ... 13

VI. Health Effects of Poor Field Sanitation ... 40

VII. Communicable Diseases ... 44

VIII. Urinary Tract Infections/Kidney Problems ... 53

IX. Heat Stress ... 56

X. Pesticide-related Illness ... 60

XI. Dermatitis ... 74

XII. Eye Problems ... 77

XIII. Musculoskeletal Problems ... 80

XIV. Accidents ... 84

XV. Noninfectious Respiratory Diseases ... 89

XVI. Cancer ... 92

XVII. Maternal and Child Health Hazards ... 94

XVIII. Other Factors Affecting Farmworker Health ... 102

XIX. Occupational Safety and Health Laws Affecting Farmworkers ... 105

XX. Additional Resources ... 113

    A. State Reports on Farmworker Issues ... 113

    B. Other ... 114

Appendix I 1985-1986 Interagency Agreement with Environmental Protection Agency (EPA) ... 121

Appendix II EPA Pesticide Reentry Intervals ... 124

I. Executive Summary

This report examines farmworker health data gathered within the past 10-15 years, describes ongoing research, discusses at both state and federal levels the laws and proposed legislation and regulations that deal with farmworker occupational safety and health, and makes recommendations for research and program priorities on farmworker health. In particular, the report is designed to be a resource document* for researchers, policy- and lawmakers, state and federal agency staff, and especially health care workers in facilities serving farmworkers. It provides the framework for a research agenda on migrant and seasonal farmworker health.

Health research on migrant and seasonal farmworkers in the United States has been scarce and fragmented, and research on the effects of their occupational problems and chemical exposure has been even more limited. Much of the existing health data is difficult to find because it is either unpublished, out-of-print, or uncatalogued. This report presents information from some of those sources.

In addition, much of the data suffer from methodological flaws or limitations. For example, some of the statistics presented in this report are simple tabulations of patient encounters at migrant health centers,** and while these numbers may present a picture of a specific clinic population, they do not necessarily provide an accurate description of the health of the general farmworker population in either the center's service area or in other parts of the country. In some cases migrant versus non-migrant patient comparisons are made, but comparisons between farmworker and non-farmworker patients or between farmworker patients and farmworkers who do not seek medical care or between the overall farmworker population and the general non-farmworker population are more difficult to make — and rarely made. Medical records may not contain the information necessary to complete retrospective (case-control) studies. Clinic-based research or community surveys take time, staff, and money, which is sorely lacking.

Federal, state, and local agencies have focused their limited resources primarily on the most evident and immediate need, providing clinical and preventive health services such as primary health care services, immunizations, and nutrition programs such as the Women, Infants, and Children or WIC program of the U.S. Department of Agriculture. Health centers and other facilities that serve migrant and seasonal farmworkers are usually understaffed and underfunded, and research projects constitute a low priority, if they are considered at all. Facilities have been funded on a model that provides incentives for those who process a greater number of patients and have more medical "encounters" rather than encourages research or other health promotion/disease prevention activities. Finally, private and public funding for farmworker health research has been minimal.

All of these factors have stood in the way of our developing a clear understanding of what has happened to farmworker health since the implementation of the federally organized and funded migrant health program in 1964. Given the current spiralling federal deficit and recent budget cuts in entitlement programs, this information becomes especially critical in setting program priorities and evaluating the effectiveness of particular program components.

Without comprehensive national health data about farmworkers (collected on a continuing basis), it is difficult to accurately determine the appropriate health services for this population, evaluate current programs, know when to make appropriate changes, correctly set program priorities, or plan for long-term needs.

Such national farmworker health data would also provide a basis for policymaking at the federal, state, and local levels. Current efforts to win for farmworkers the right to workplace sanitation facilities and greater protection from pesticides in the workplace have relied heavily on the existing, though piecemeal, health data about farmworkers. To the extent that scientific data is unavailable, such efforts are hampered.

The occupational health problems covered in this report include:

- Communicable diseases
- Urinary tract infections/kidney problems
- Heat stress
- Pesticide-related illness
- Dermatitis
- Eye problems
- Musculoskeletal problems
- Accidents
- Noninfectious respiratory diseases
- Cancer
- Hazards for children in the fields
- Hazards for pregnant women and/or the newborn.

These conditions are not mutually exclusive. In fact, the presence of one condition may increase an individual's risk of developing other problems; for example, a dehydrated farmworker is more susceptible to the toxicity of pesticides.

In this report, other factors that affect farmworkers' overall health (and which may place a farmworker at particular risk given the occupational hazards of agriculture) also are discussed. These include, for example, other existing medical conditions such as diabetes, hypertension, nutritional deficiencies such as anemia, abuses such as peonage and violence, and myriad other problems (e.g., alcoholism and drug abuse).

Substandard unsanitary housing also contributes to the spread of disease, and since much migrant farmworker housing is provided by the employer, living conditions, especially where farmworkers' abodes are exposed to pesticide spraying, also can be categorized as workplace risks.

---

*Besides the references listed at the end of each chapter, this report contains a bibliography (Chapter XX) of additional resources which includes audiovisual and other training materials.

**Funded by the Office of Migrant Health, U.S. Department of Health and Human Services, under the Public Health Service Act, Title III, Part D, Section 329.

Report Findings

The general findings of this report are outlined below:

(1) The migrant farmworker population suffers health problems related to poor sanitation and overcrowded living conditions at rates much higher than the non-farmworker population.

(2) Provision, maintenance, and use of field sanitation facilities such as toilets, handwashing facilities, and sufficient potable drinking water at the worksite would substantially decrease the incidence of sanitation-related health problems among farmworkers.

(3) Even in states with field sanitation standards, sanitary facilities and drinking water are infrequently provided by agricultural employers. State enforcement of sanitation regulations is virtually nonexistent in this environment.

(4) The majority of farmworkers and their families seek medical treatment for acute ailments rather than chronic conditions or preventive services such as check-ups or immunizations.

(5) Parasitic infections afflict migrant farmworker adults and children an average of 20 times more than the general population, and estimates of prevalence of these infections range from 27-59% in this group. (These rates are comparable to those reported in Third World countries.) Recurrent parasitic infections have serious implications for childhood growth and development, both physical and mental.

(6) The full extent of both acute and chronic pesticide poisoning among farmworkers still is not known.

(7) The dangers of agricultural labor on women, particularly pregnant farmworkers and their newborn, and on the development of farmworker children, are poorly documented.

(8) The health problems most frequently reported at migrant health clinics include dermatitis, injuries, respiratory problems, musculoskeletal ailments (especially back pain), eye problems, gastrointestinal problems, hypertension, and diabetes.

(9) According to the Centers for Disease Control, agriculture is the second most dangerous occupation in the United States, yet farmworkers are rarely offered or seldom able to afford health insurance. In 20 states, they are not covered by workers' compensation of any kind.

Report Recommendations

The report recommendations, which are outlined below, are fully discussed in Chapter II.

(1) Improve coordination and communication among agencies at the national, state, and local levels that serve farmworkers;

(2) Give funding priority to preventive health care projects and services;

(3) Devise ways to make health care services available and accessible to more farmworkers (e.g., explore models for farmworker health insurance coverage);

(4) Develop a training program on farmworker occupational health for migrant health center clinical staff, including standardized clinic protocols where appropriate;

(5) Institute a national clearinghouse/resource center on migrant and seasonal farmworker health issues;

(6) Encourage migrant health program personnel to submit comments and testify when federal or state legislation/regulations that affect farmworker health are proposed;

(7) Delineate the current and future research priorities of federal agencies, identifying public and private sources for migrant farmworker health research;

(8) Establish a standardized farmworker health data-gathering system through the federally funded migrant health centers. Analyze existing farmworker information, especially computerized data bases. Where appropriate, develop additional research projects based on these findings;

(9) Further develop or facilitate research projects between migrant farmworker health programs and academia, including, for example, schools of medicine, public health, nursing, and optometry;

(10) Provide pre- and/or postdoctoral training fellowships for migrant farmworker health research;

(11) Develop health studies that are collaborative, multi-center efforts designed to increase knowledge on key migrant and seasonal farmworker health issues;

(12) Develop culturally appropriate health education materials for farmworkers on workplace health and safety, preventive health care, including dental health, deafness prevention, infant feeding practices, child growth and development, nutrition, family planning, sexually transmitted diseases, substance abuse, and use of medications; and

(13) Improve the compatibility and efficiency of computer systems used by migrant health centers.

This report illustrates what we do not know about migrant and seasonal farmworker health as much as what we do know. Some of the most basic health statistics have not been collected and are still unknown, for example, average life expectancy, infant mortality, and immunization rates among farmworker children. Thus, further documentation of farmworker family health is sorely needed, and more research is necessary if we are to find the most effective means of promoting health and preventing disease in this multiracial, multicultural population.

Priority must be placed on preventive services — services targeted to the *total* farmworker environment, including the workplace, living quarters, and school — in order to promote a healthier farmworker population and to prevent the suffering and pain of acute illness and chronic disability as well as reduced income from lost wages. In addition, prevention is more cost-effective than medical treatment or rehabilitation once illness or injury occurs. For example, diseases resulting from poor sanitation run rampant among the farmworker population but can be prevented cheaply and easily.

Specifically, the highest priority should be given to the following preventive measures:

- Projects that attack the causes of poor sanitation, such as housing and water quality improvement, sewage control, and provision, maintenance, and use of field sanitation facilities;
- Programs that eliminate overcrowded living conditions;
- Elimination of workplace hazards;
- Health education, including worker health and safety training; and
- Provision of preventive health services, such as dental, hearing, hypertension, and diabetes screening, family planning, and pre- and postnatal care.

Migrant and seasonal farmworkers are vital to the prosperity of agricultural communities that grow labor-intensive crops such as fruits and vegetables. A study in upstate New York conducted by the State University of New York at Buffalo revealed that during the 1983 migrant season, $4 million had been pumped into that area's economy: 75% of this total resulted from farmworkers themselves buying local goods and services, the other 25% from state and federal funds received by local agencies to operate farmworker services. It is not just altruism but also good economic policy to keep these workers healthy and provide accessible, affordable health care for them.

These workers endure substandard living conditions, suffer infectious disease rates comparable to those found in developing nations, labor in one of the most dangerous occupations in the nation, and have limited access to affordable health care. In order to significantly improve their health and well-being, we must confront and remove the causes of farmworkers' diseases and the workplace hazards they face.

II. Recommendations*

A comprehensive research program entails not only coordination and funding of new research projects, but also a commitment to the implementation of research findings. The migrant farmworker health literature is replete with recommendations made within the past 20 years that while still valid, have yet to be implemented.

Clearly, the goal of collecting and analyzing farmworker health data is not simply to amass information but to find ways to improve the health and well-being of that population. It is quite possible that such research may indicate the need for a change in the method of delivery or financing of health services. On the other hand, a sound data base can be used to support legislation and regulations to improve the living and working conditions of farmworkers and their families. Research findings may point to creative solutions to the perennial problems confronting migrant and seasonal farmworkers. By finding remedies that address the roots of social, health, and economic problems, we will provide real solutions rather than just stopgap measures.

Another important point to consider is the ability of the migrant health facilities to treat or provide services for farmworkers who are found, in the course of a research project, to have a particular condition. More than one migrant health center director interviewed for this report raised the issue of the ethics of collecting data for data's sake. It is clear that farmworkers and their families must have the possibility for treatment and not become mere research subjects.

The report recommendations, which were listed in the Executive Summary, are more fully discussed below.

1. Improve coordination and communication among agencies at the national, state, and local levels that serve farmworkers.

Given the limited financial resources available for migrant and seasonal farmworker programs, it is imperative that the agencies serving farmworkers coordinate their programs more effectively.

Coordination and communication at all levels should include the following components: assessing the needs of the farmworker population and the current available resources; establishing long- and short-term priorities; developing programs and resources to meet these needs given the long- and short-term goals; and evaluating the effectiveness of these programs and resources.

At the federal level, quarterly interagency staff meetings are held with participants from the Departments of Health and Human Services, Education, Labor, Agriculture, and the Environmental Protection Agency as well as private nonprofit national farmworker organizations and contractors conducting farmworker projects for federal agencies. To date, however, these meetings have served more as a forum for exchanging information than as a means of developing interagency policy.

This report identifies key areas for farmworker research and, thus, initiates a research agenda for federal agencies serving the migrant and seasonal farmworker population. Federal interagency efforts should include the identification of research priorities, the allocation of funds for research, the identification and exchange of resources (people, books, data, etc.), data collection and analysis, and dissemination of information.

Interagency collaboration on research projects could provide pertinent information to more than one agency both more cheaply and more efficiently. Given the high costs of conducting large-scale national surveys, it makes sense — both fiscally and otherwise — to have the various agencies combine efforts and jointly collect information. These collaborative research efforts would also lead to standardization of definitions and methodology, again increasing cost and program effectiveness. Meetings of interagency researchers involved with farmworker issues and investigators who conduct farmworker research at universities, in state governmental agencies, etc. would be a valuable part of this process.

More extensive participation by migrant health programs (including the migrant health centers, Migrant Head Start, the Department of Labor's Employment and Training Administration and the Division of Farm and Child Labor Programs in its Employment Standards Administration, and the Women, Infant and Children (WIC) nutrition program of the U.S. Department of Agriculture) in the national annual migrant education meeting and of migrant education programs in the annual migrant health meeting hosted by the National Association of Community Health Centers would also facilitate the exchange of information, especially on recent research efforts.

The federal agencies also should encourage and reward collaborative efforts at the state and local levels by funding those programs that make greatest use of available resources and do not operate in an isolationist or territorial manner.

Improvement of farmworkers' health entails more, however, than simply providing more health services or making existing facilities more accessible; the housing, nutrition, and working conditions of farmworkers must also be monitored, and most importantly, improved. Collaboration and communication at the federal, state, and local levels are essential if we are to improve farmworkers' health and their general standard of living.

2. Give funding priority to preventive health care projects and services.

Preventing disease is much more desirable than rehabilitating or effecting a cure after an illness or injury has occurred. Preventive services must encompass the farmworker's total environment, including work, home, and the school.

---

*All of the recommendations in this section assume the commitment of the Office of Migrant Health and the U.S. Public Health Service (U.S. Department of Health and Human Services) to promote a coherent national research program on migrant and seasonal farmworker health.

Diseases caused by poor sanitation run rampant among farmworkers at rates comparable to those in Third World countries; yet, these diseases could easily be prevented.

The following preventive measures should be given highest priority:

- Projects that attack the causes of poor sanitation, such as housing and water quality improvement, sewage control, and provision, maintenance, and use of field sanitation facilities;
- Programs that eliminate overcrowded living conditions;
- Elimination of workplace hazards;
- Health education, including training the farmworkers themselves in health and safety; and
- Preventive health services, such as dental, hearing, hypertension, and diabetes screening, family planning, and pre- and postnatal care.

3. Devise ways to make health care services available and accessible to more farmworkers (e.g., explore models for farmworker health insurance coverage).

In FY 1985, the 122 federally funded migrant health centers in over 300 rural areas provided health care to some 460,000 migrant and seasonal farmworkers and their families; yet these facilities reached only 17% of the nation's migrant and seasonal farmworkers and their dependents.

A variety of obstacles stand in the way of adequate medical care for farmworkers, including:

- Lack of transportation from the fields or labor camps to a health care facility;
- Lack of money to pay for health care services combined with limited or nonexistent health insurance coverage;
- Reluctance of farmworkers to leave work and lose wages by going to a doctor during the workday;
- Limited health clinic hours and long waiting periods for appointments, due to shortage of funds and clinic staff;
- Cultural obstacles to farmworkers seeking medical care, (e.g., adult men equating sickness with weakness);
- Language barriers between farmworkers and health care providers; and
- Major cutbacks in critically important support programs.

Means for making health care more available, accessible, and affordable must be investigated. It is particularly critical to study ways of making hospital care more accessible to farmworkers. A survey of migrant health clinics (Smith, 1985) revealed that an average of 51% of the patients (range = 10-97%) were completely uninsured (i.e., had no third party insurance and were not covered under Medicare or Medicaid), while almost 60% of the hospitals to which these patients were referred required a deposit before treatment could begin.

There are only a few insurance plans that provide farmworker hospitalization insurance; these include Laredo (Texas) Blue Cross/Blue Shield, Mutual of Omaha, and the Florida Agricultural Health Plan of Blue Cross/Blue Shield in Jacksonville, all of which are funded by the Office of Migrant Health, U.S. Department of Health and Human Services.

4. Develop a training program on farmworker occupational health for migrant health center clinical staff, including standardized clinic protocols where appropriate.

Health care providers generally do not receive sufficient training in occupational medicine, a serious deficiency for migrant health center clinicians due to the wide range of health hazards their patients face in the fields, work camps, or other living quarters, and the unique problems of serving a population that is both migratory and most often from a different culture.

Occupational health training should include the identification and treatment of work-related illnesses and injuries, instruction in how to take an occupational history, explanation of clinic protocols, and updated information on current health problems among the farmworker population (e.g., epidemics, tropical diseases, such as parasitic infections among migrants from Central America). In addition, this training should include how to diagnose and treat pesticide-related illness and where and how to report such cases at both the state and federal levels. Part of this standardized instruction should include a training manual and audiovisual materials, which would serve as reference sources for each migrant health center.

Actual visits to work sites and labor camps for firsthand views of farmworker life should also be a component of training for migrant health care providers, including physicians, nurses, dentists, etc. It is also essential that such training include instruction in the cultures of the migrant farmworker patient population.

Some migrant health centers provide annual training sessions but others do not. At the very least, attendance at a training session(s) should be mandatory for all newly hired migrant health center clinical staff, including physicians, dentists, and nurses. As an incentive, participants could be awarded continuing education credits. "Refresher" courses could be presented as part of State Health Department training programs, sessions at annual professional conferences, continuing medical education offerings at areas hospitals/medical schools, or conferences through Area Health Education Centers (AHEC's).* Given that many of the migrant health care providers are doctors serving two-year stints in the National Health Service Corps, such training could be coordinated to some extent with the orientation program conducted by the Corps.

If training is conducted at a migrant health center, other clinicians in the community who may treat migrant farmworkers, such as hospital emergency room personnel, local health department personnel, and private physicians and dentists should be invited to participate.

---

*The Area Health Education Centers program (U.S. Department of Health and Human Services, Public Health Service, Health Resources and Services Administration) was established to provide funding for community-based health education and training and to address the issues of distribution, supply, quality, use, and efficiency of health care personnel.

Some standardization of clinic protocols for the federally funded migrant health centers would be valuable. For example, a standardized protocol would eliminate much confusion in the diagnosis and management of pesticide-related illness. When and how blood tests should be done, when and how urine samples should be collected, where samples should be sent for analysis, what questions should be asked of the patient, how to determine which pesticide was used, treatment, reporting, and follow-up all are recurring issues for migrant health care providers that should be addressed. Another example is that of tuberculosis. The Centers for Disease Control (1985) issued a much-needed report for clinicians on the diagnosis and treatment of tuberculosis in migrant farmworkers.

As was stated before, interagency communication and cooperation are essential. On the pesticide issue, for example, the Office of Migrant Health works with the Environmental Protection Agency (see Appendix I for a copy of the Interagency Agreement between the Office of Migrant Health and the EPA). Such collaboration should extend to the Office of Migrant Health and the National Institute for Occupational Safety and Health (NIOSH).

5. **Institute a national clearinghouse/resource center on farmworker health issues.**

Such a center would serve several key functions:

- It would provide a library for farmworker health materials; since much of this literature is either out-of-print, unpublished, or uncatalogued, a central repository would be valuable for researchers, practitioners, and policymakers alike. The center would collect training materials, such as slide presentations, manuals, brochures, and other health education materials. It would also collect testimony on migrant farmworker health matters that was presented to Congress or at federal agency administrative hearings.
- The center would be a clearinghouse for information on ongoing migrant and seasonal farmworker health research and health education projects, facilitating communication not only among migrant health investigators, but also between those researchers currently conducting studies and those planning farmworker health projects or those conducting or planning research in areas related to farmworkers, (e.g., agriculture, rural populations, or on diseases shown to be prevalent in migrant farmworkers). Such information would preclude duplicative efforts and could lead to multi-center collaborative research studies.
- The center could sponsor seminars, conferences, and intercultural exchanges on migrant and seasonal farmworker health issues.

The migrant health care provider community itself is often unaware of research that is being conducted, as well as the results of those studies. The existence of such a national farmworker resource center would remedy this situation. Dissemination of such information has begun through the National Migrant Referral Project's bimonthly newsletter, the *Migrant Health Newsline* (see Chapter XXB "General" for more information).

As discussed in the first recommendation, interagency coordination and communication are imperative. Other depositories of farmworker information should be linked with such a farmworker health resource center. For example, the Office of Migrant Education in the U.S. Department of Education funds the computerized Migrant Education Resource List and Information Network (MERLIN) available to migrant education and migrant health personnel, Project TEACH, which develops and distributes curricula on pesticides and other environmental hazards, and Project HAPPIER, which develops and disseminates health education curricula. The farmworker resource center should have information about what resources those projects include and have access to them. In addition, if the U.S. Environmental Protection Agency establishes its proposed university-based farmworker study center on pesticides, information should be shared so that the identification and collection of resources are not duplicated. Regular communication among all such centers would ensure that their information is more comprehensive and up-to-date at less cost because duplication of effort would be avoided.

6. **Encourage migrant health program personnel to submit comments and testify when federal or state legislation/regulations affecting farmworker health are proposed.**

The encouragement of the Office of Migrant Health for migrant health programs to submit comments or testimony in 1984 to the Occupational Safety and Health Administration on the proposed field sanitation standards resulted in the development of a strong and essential scientific record on the adverse effects to farmworker health due to a lack of field sanitation. Although the decision to promulgate a federal field sanitation standard is still pending, this documentation has also proved useful with regard to state field sanitation regulations.

7. **Delineate the current and future research priorities of federal agencies, identifying public and private sources for migrant health research.**

In order to determine what importance agricultural health research has at the federal level, it is necessary to identify the current long-term research priorities, budgets, and key decisionmakers in the various agencies. For example, the research agendae of the National Institutes of Health, the Centers for Disease Control including the National Institute for Occupational Safety and Health (NIOSH), and the National Center for Health Statistics, should be ascertained, as well as the agendae for the other federal agencies with farmworker programs (i.e., the U.S. Environmental Protection Agency, and the U.S. Departments of Labor, Education, and Agriculture). In addition, other programs within the Department of Health and Human Services, the most logical source for federal funding of farmworker health research, should be surveyed.

The Office of Migrant Health should have a place on any national health policy task force, such as the Second and Third Task Forces for Research Planning in Environmental Health Services, which make recommendations on research priorities.

Private foundations and professional organizations should be surveyed for information on the farmworker health projects they currently fund or have financed, and their interest in further funding such research or health education projects also should be examined.

Research areas that should be explored include studies of farmworkers' health status (both morbidity and mortality), their utilization of health services, and health care financing. Some possible areas to study and the proposed federal and private funding sources for such studies are outlined below:

- Further documentation of infectious disease transmission and sources of contamination in labor camps and at the worksite (with the Centers for Disease Control);
- A study of state temporary labor camp housing standards and the enforcement of those standards;
- Ways to improve the continuity of care for migrant farmworkers, including methods of transmitting medical information between health care providers, the use of computers, etc.;
- The prevalence and causes of respiratory/lung problems among farmworkers and their children (through the National Institute of Allergy and Infectious Disease, the National Institute for Occupational Safety and Health (NIOSH), or the National Heart, Lung and Blood Institute);
- Health needs of farmworker population groups such as adult males and teenagers who generally do not use health care services;
- Methods for providing insurance coverage, including hospitalization insurance for farmworkers and their families (with the Health Care Financing Administration);
- Mental health problems, including the prevalence of depression, alcoholism, anxiety, drug abuse, and child abuse among farmworkers (with the National Institute of Mental Health or the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) of the Department of Health and Human Services);
- Farmworker mortality studies to determine rates and causes of infant and maternal mortality, rates and causes of death for all ages, and life expectancy for the farmworker population. The life expectancy of farmworkers is commonly quoted as 49 years, but this is a statistic from the mid-1960's, which was based on very limited data (Johnston, 1985; U.S. Senate, 1970). Mortality studies could include autopsies to determine pesticide body burdens (in conjunction with the Environmental Protection Agency);
- Studies of the extent of exposure and chronic health effects of pesticide exposure (with the U.S. Environmental Protection Agency, the National Institute for Occupational Safety and Health, the National Institute of Mental Health and/or the National Institute of Neurological and Communicative Disorders and Strokes);
- The extent of child labor in agriculture, the general health status of migrant and seasonal farmworker children, and their health problems from occupational exposures, for example, the effects of hard physical labor on the growth and development of farmworker children, effects of exposure to pesticides, the rates and types of accidents involving farmworker children, lung problems, handicapping conditions, etc. (through the National Institute of Child Health and Human Development, the National Institute for Occupational Safety and Health, the Administration for Children, Youth and Families, the March of Dimes, and/or the American Academy of Pediatrics, in conjunction with the Migrant Head Start program, the Office of Migrant Health, and the Office of Migrant Education).
- Musculoskeletal problems of farmworkers and their children (in conjunction with the National Institute for Occupational Safety and Health (NIOSH), the National Institute of Arthritis, Diabetes and Digestive and Kidney Diseases, the Arthritis Foundation, and/or the National Institute of Child Health and Human Development);
- The prevalence, causes, and prevention of vision deficiency (with the National Eye Institute and the Association of Schools and Colleges of Optometry);
- A study of the prevalence of chronic health conditions in the farmworker population such as hypertension, diabetes, cancer, dental disease, musculoskeletal problems, mental health problems, and other handicapping conditions (in conjunction with the National Center for Health Statistics, the Department of Health and Human Services, or the National Institutes of Health);
- Family planning among the farmworker population, including common beliefs and taboos; and
- The most effective means of promoting health and preventing disease, for example, types of health education, ways to encourage patients to make use of available health care, health screening tests, etc.

8. Establish a standardized farmworker health data-gathering system through the federally funded migrant health centers. Analyze existing farmworker information, especially computerized data bases. Where appropriate, develop additional research projects based on these findings.

The systematic collection of farmworker health data nationwide through the federally funded migrant health centers is sorely needed. Currently the only national reporting system that tracks farmworker health data is the Migrant Student Record Transfer System maintained by the Office of Migrant Education, U.S. Department of Education. A national morbidity reporting system of the 10 most frequently diagnosed health problems at migrant health centers is slated to begin operation at the National Migrant Referral Project, Austin, Texas, in 1986 with funding provided by the Office of Migrant Health.

In conducting the research for this report, the following data bases, which have either not yet been analyzed or may be useful for additional analysis, were identified:

- The computerized Migrant Student Record Transfer System data maintained by the Office of Migrant Education of the U.S. Department of Education in Little Rock, Arkansas, with its health data available via the National Migrant Referral Project, Inc., Austin, Texas;
- Farmworker data from the Hispanic HANES (Health and Nutrition Examination Survey) conducted by the National Center for Health Statistics;
- Diagnostic data from migrant health programs using the COSTAR computer programming package (e.g., North County Health Services, San Marcos, California; Su Clinica Familiar, Harlingen, Texas; the West Palm Beach, Florida County Health Department); and
- Migrant Head Start data, particularly regarding handicapping conditions.

9. Further develop or facilitate research projects between migrant farmworker health programs and academia, including, for example, schools of medicine, public health, nursing, and optometry.

Migrant health centers generally do not have the capabilities of staff, computer resources, or funding to conduct research projects on their own. Research cooperation between the centers (with the patients and data) and universities (with the staff, research expertise, and computer facilities) has proven successful, for example, in the ongoing parasite studies in North Carolina with TriCounty Community Health Center (Newton Grove, North Carolina) and the University of North Carolina School of Public Health and in the 1984 study in upstate New York with the Oak Orchard Community Health Center (Brockport, New York) and the State University of New York at Buffalo.

10. Provide pre- and/or postdoctoral training fellowships for migrant farmworker health research.

The U.S. Public Health Service already does something similar for clinical support (i.e., the National Health Service Corps physicians). Various entities in the National Institutes of Health provide universities with stipends for graduate or postgraduate researchers. This type of funding would provide some of the financial backing necessary for university involvement in migrant farmworker health research.

11. Develop health studies that are collaborative, multicenter efforts designed to increase knowledge on key migrant and seasonal farmworker health issues.

Due to personnel, budget, and time constraints, much of the data-gathering on migrant and seasonal farmworkers' health is done only through small samples. Given more communication and cooperation among various researchers, health studies could be performed at various sites within a particular migrant "stream" or even across regions. For example, a health status study among the migrant health centers that use the COSTAR package might be developed. A mortality study of farmworkers in the home-base states of Florida, Texas, and California could be accomplished as a collaborative project. (Such efforts would require the support of the Office of Migrant Health.)

12. Develop culturally appropriate health education materials for farmworkers on workplace health and safety, preventive health care, including dental health, deafness prevention, child growth and development, infant feeding practices, nutrition, family planning, sexually transmitted diseases, substance abuse, and use of medications.

Occupational safety and health training materials for farmworkers are few and generally available only in English and Spanish. The Migrant Health Program should take a more active role in the distribution of both existing occupational health and general health educational materials developed by migrant health centers or other sources.

It would also be useful to explore ways to involve crewleaders and growers in the promotion of workplace health and safety.

The Project HAPPIER study conducted by Trotter (1984) provides information that should be considered in developing health education materials for farmworkers. In this study, farmworkers were asked about their major and minor health problems, how they treated those problems, and for which health problems they wanted further information.

It is clear that methods for reaching the illiterate farmworker must also be developed, tested, and evaluated. Mass media health education advertising, such as radio and TV public interest messages in Spanish, English, and Creole, could be aired during the harvest season or other key times of agricultural labor. Such radio or TV messages should be broadcast in the early morning or during evening hours when farmworkers would be able to hear or watch them. Agricultural hazards could be targeted since these can affect farmworkers, farmers, and even the general rural community (e.g., pesticide spraying, children's access to pesticide containers, water quality and general sanitation information).

It might be possible to involve the Advertising Council of America in such an effort, especially since the Council already has worked with the National Institutes of Health on other such health promotion/disease prevention programs.

13. Improve the compatibility and efficiency of the computer systems in use by migrant health centers.

The Mitre Corporation already has published an analysis of computer facilities of the federally funded migrant health centers (Harrington, 1984). Apparently the use of computers for billing, payroll, and general ledger functions is growing, although this is not true for the more complex activities of collection and analysis of diagnostic information. Nationwide coordination and computerization could improve continuity of care for migrant farmworkers by increasing accessibility to medical records. Health research capabilities also could be enhanced if systems such as COSTAR, which enables users to retrieve and analyze diagnostic data, were put in place.

REFERENCES CITED

Centers for Disease Control: Tuberculosis and Migrant Farm Workers. June 1985. Available from the National Migrant Referral Project, Inc., 2512 South I.H. 35, Suite 220, Austin, TX 78704. (phone: 512-447-0770).

Harrington, M.B.: *The 1983 Migrant Health Project Automated Information Systems Survey: A Summary of Results*. McLean: MITRE Corporation, Metrek Division, 1820 Dolley Madison Boulevard, McLean, VA 22102, February 1984.

Johnston, H.: Telephone interview with Helen Johnston, former director of the Migrant Health Program, October 11, 1985.

Smith, D.: Unpublished data presented by David Smith, M.D., Medical Director, Brownsville Community Health Center, 2137 East 22nd Street, Brownsville, TX 78520 (phone: 512-542-4331) at the 1985 annual meeting of the American Public Health Association, Washington, D.C., November 1985.

Trotter, R.T., II: Project HAPPIER Final Report of Survey Results: Migrant Family Survey. September 21, 1984. Copies available from: Project HAPPIER, Pennsylvania Department of Education, 333 Market Street, Harrisburg, PA 17126-0333 (phone: 1-800-233-0306 or in Pennsylvania 1-800-222-1936 or 717-783-7093).

U.S. Department of Health, Education, and Welfare: *Human Health and the Environment — Some Research Needs. Report of the Second Task Force for Research Planning in Environmental Health Science*. Washington, D.C.: USDHEW, Public Health Service/National Institutes of Health and National Institute of Environmental Health Sciences, DHEW Publication No. NIH 77-1277, 1977.

U.S. Senate: *Migrant and Seasonal Farmworker Powerlessness. Hearings before the Subcommittee on Migratory Labor of the Committee on Labor and Public Welfare*. Ninety-first Congress, First and Second Sessions on Who is Responsible. Part 8-B, July 21, 1970. Washington, D.C.: U.S. Government Printing Office, 1971, p. 5407.

III. Purpose Of This Report

In the last thirty years, a variety of newspaper exposés, television documentaries, government studies, and Congressional hearings have focused on the plight of farmworkers in the United States. Much of what Edward R. Murrow showed about migrant farmworkers in the 1959 broadcast *Harvest of Shame* is still relevant today. The problems of poverty, isolation, exploitation by crewleaders (including peonage in some cases), and unhealthy living and work conditions have not disappeared.

Health research on migrant and seasonal farmworkers in the United States has been scarce and fragmented, and research on the effects of their occupational exposures has been even more limited. As we stated earlier, much of the existing health information is difficult to find because it is unpublished, out-of-print, or uncatalogued. In this report we have reviewed and consolidated the occupational health literature and data on farmworkers collected during the past 15 years. It is meant to be a convenient reference source for staff of the 122 federally funded migrant and community health centers serving farmworkers; the Office of Migrant Health, Bureau of Health Care Delivery and Assistance, U.S. Department of Health and Human Services; other federal agencies dealing with farmworkers, such as the U.S. Department of Labor, the Environmental Protection Agency, and the Department of Agriculture; state health departments, especially their migrant health divisions; researchers; social service and farmworker advocacy organizations; policy- and lawmakers; and the general public. By identifying issues requiring research, this report provides the framework for a research agenda on farmworker health.

This volume contains the following:

- An overview of the major occupational health problems reported by migrant health centers;
- A summary of the literature on each agricultural health problem presented;
- Information on ongoing research projects on farmworker occupational health;
- Recommendations for research priorities on farmworker health;
- Information on occupational safety and health laws covering agricultural workers;
- A resource guide on farmworker occupational safety and health, including training materials.

Methodology

Material for this report was collected in four ways:

(1) In-person and telephone interviews with migrant health clinicians and administrators, state health department and social services staff, research scientists, and federal agency staff;

(2) Computerized literature searches (MEDLINE and the National Institute for Occupational Safety and Health's (NIOSH) on-line bibliographic retrieval system);

(3) A questionnaire distributed to participants at the 1984 Annual Migrant Health Conference sponsored by the National Association of Community Health Centers;

(4) Testimony of witnesses at hearings (May-June 1984) on the field sanitation standards proposed by the Occupational Safety and Health Administration, U.S. Department of Labor (i.e., the provision of drinking water, toilets, and handwashing facilities for farmworkers in the fields).

IV. Farmworker Demographics

Identification and follow-up of farmworker populations present difficulties not found in more stable industrial worker populations because of factors such as worker mobility, undocumented laborers, and rural locations. The Office of Migrant Health estimates that there are approximately 2.7 million migrant and seasonal farmworkers and dependents nationwide including 800,000 migrant farmworkers and dependents and 1,900,000 seasonal farmworkers and dependents. Other migrant farmworker estimates range from 317,000 to 1.5 million, and up to 3.5 million seasonal workers, including dependents.

The very nature of the farmworker population makes data collection and research difficult. This is particularly true in the case of migrant farmworkers, whose mobility severely hampers accurate counting and follow-up. The unknown number of undocumented farmworkers also affects the reliability of statistics. Language barriers, the seasonal nature of the work, and the large distances between camps or farms in rural, often remote, areas also create difficulties. The changing composition of the farmworker population (e.g., due to national and international political and economic situations such as changes in the U.S. farm economy, changes in U.S. immigration policy, and war in Central America) adds uncertainty to health forecasting and planning.

Even the most basic description of a farmworker population can be difficult; for example, in some areas the agricultural workforce consists largely of the urban poor, who are bussed out to farms each day and returned home in the evening. These "dayhaul" laborers are even more difficult to track than migrant farmworkers who live in designated labor camps: they change daily; they may come from various cities; and they are not normally seen in rural migrant health centers. Their irregular work patterns make it more difficult to quantify and monitor their exposure to agricultural hazards, especially when compared to a crew of migrant farmworkers who live in the same camp and work on a particular farm until a crop is harvested.

The diversity of farmworkers in a given agricultural region is illustrated in southern New Jersey, where the farmworker population includes white, black, southeast Asian, and Hispanic men, women, and children dayhaul laborers from Philadelphia, Trenton, Camden, and even as far north as Newark and New York City, male migrant Puerto Rican, American black, and Jamaican workers living in labor camps, Mexican American migrant farmworker families living in towns and camps, seasonal farmworkers living year round in southern New Jersey, and, in 1983, for the first time, a crew of Haitian farmworkers.

In the Midwest, approximately 90% of the migrant farmworkers are Hispanics. Native Americans do agricultural labor in the West and Southwest, such as the Kickapoo and Navajo in Utah and the Navajo in Arizona. Hispanic and Haitian crews travel up the East Coast doing farmwork. West Indian workers such as Jamaicans are brought into the country by U.S. employers to pick apples in the East.

Another problem in data collection and comparison with existing statistics is the absence of a uniform definition of migrant and seasonal farmworkers throughout all government agencies. At present, the U.S. Departments of Agriculture, Labor, Health and Human Services, and Education all use different standards for counting the farmworker population, making data across agencies not strictly comparable. For example, the Economic Research Service of the U.S. Department of Agriculture defines seasonal farmworkers as persons who did 25-149 days of farm wage work in one year, while the Office of Migrant Health, Department of Health and Human Services defines a seasonal farmworker as "an individual whose principal employment is in agriculture on a seasonal basis and who has been so employed within the last 24 months and who is not a migrant" and a migrant farmworker as "an individual whose principal employment is in agriculture on a seasonal basis, who has been so employed within the last 24 months and who establishes for the purpose of such employment a temporary abode." The Department of Education definition for a migrant child includes children whose parents work in agriculture, food processing, fishing, or fishery-related industries. Children in families who have settled out of the migrant stream are still classified as "migrant" for five years after settlement.

The Office of Migrant Health estimates that there are about 800,000 migrant farmworkers and dependents and about 1,900,000 seasonal farmworkers and dependents nationwide (U.S. Department of Health and Human Services, 1980). These estimates were reached by using data from the U.S. Department of Labor's Employment Service, state departments of labor, migrant health centers, and other sources. It should be noted, however, that in this tally, seasonal farmworkers and their dependents are only included in population estimates in counties that show a significant migrant farmworker population, i.e., "high impact" counties with 4,000 or more migrant farmworkers or a combination of migrant and seasonal farmworkers totalling more than 4,000 workers. Thus, the seasonal farmworker population is underestimated because in accordance with the Bureau of Health Care Delivery and Assistance service area criteria, counties with seasonal farmworkers but no migrant farmworker influx are excluded from the statistics. A Legal Services Corporation study (Lillesand et al., 1977), using federal and state data, estimated that there were about 1.5 million migrant farmworkers, including dependents, and 3.5 million seasonal workers, including dependents.

In contrast, the U.S. Department of Agriculture reports a decrease in migrant farmworkers of almost 50% between 1949 and 1979, from 422,000 to 217,000 farmworkers. The Department of Agriculture based its estimates on data obtained in December 1979 from supplementary questions in the Current Population Survey (CPS) of the Bureau of the Census. (Puerto Rico was not included in this survey.) Foreign nationals who did hired-farmwork in the United States and returned home (e.g., to Mexico) before the field data collection was completed, were not included. Since this information was collected in winter, farmworkers were "undercounted." Furthermore, minority groups and undocumented farmworkers are more difficult to count because they are afraid to talk to officials or often are unable to speak English. The Department of Agriculture admitted that if undocumented farmworkers in agriculture were counted, they could more than double the estimate of 217,000, that slightly over 100,000 undocumented farmworkers in agriculture are apprehended each year, and that as many as 355,000 undocumented workers may be employed annually in agriculture. Most are concentrated in the Southwestern and Pacific states, and the remainder are scattered throughout the nation (U.S. Department of Agriculture, 1981).

In 1979, according to the U.S. Department of Agriculture (1981), over half (53%) of the farmworkers in California, Nevada, and Arizona were Hispanic, and about 34% of the workers in eight Southern states (Kentucky, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida) were black or of some other racial/ethnic origin.

In addition, although minority groups account for a relatively small number of hired farmworkers nationwide, minorities, especially Hispanics, are much more dependent on agriculture than whites. The data suggest that farmwork serves more as an entry level and/or supplemental job for whites, although it is more likely to constitute the major source of support for minority workers (U.S. Department of Agriculture, 1981).

Child labor also is important in agriculture. Even though industrial child labor was outlawed in 1938, there are only a few states that set a minimum age for child farm labor outside school hours, and very little is done to enforce these laws (Fuentes, 1974). A report by the American Friends Service Committee (1970) found that one-fourth of all farm labor in the U.S. is performed by children. In 1981, according to the U.S. Department of Labor, an estimated 397,000 children, aged 8 through 15, worked in agriculture as compared with 1.2 million adults (DiPerna, 1981).

REFERENCES CITED

American Friends Service Committee: Child Labor in Agriculture. Report done in cooperation with the National Committee on the Education of Migrant Children, Summer, 1970.

DiPerna, P.: The Lethal Cloud of Indifference. *The Nation*, June 27, 1981, pp. 786-789.

Fuentes, J.A.: The Need for Effective and Comprehensive Planning for Migrant Workers. *American Journal of Public Health* 64(1):2-4, 1974.

Lillesand, D., Kravitz, L., and McClellan, J.: *An Estimate of the Number of Migrant and Seasonal Farmworkers in the United States and the Commonwealth of Puerto Rico*. Washington, DC: Legal Services Corporation, May 1977. For more information, contact: Ms. Bea Bobotek, Librarian, Migrant Legal Action Program, Inc., 2001 "S" St., N.W., Suite 310, Washington, D.C. 20009.

U.S. Department of Agriculture: *Hired Farmworkers: Background and Trends for the Eighties*. Rural Development Research Report Number 32. Washington, D.C.: Economic Research Service, 1981.

U.S. Department of Health and Human Services: *1978 Migrant Health Program Target Population Estimates*. Rockville, MD: Health Services Administration, Bureau of Community Health Services, April 1980. Contact: Office of Migrant Health, Parklawn Building Room 7A-55, 5600 Fishers Lane, Rockville, MD 20857 (phone: 301-443-1153).

V. A Review Of Recent Data On The Health Status Of Farmworkers

Recent farmworker health data from migrant health centers and community surveys in ten states (Florida, North Carolina, New York, Michigan, Wisconsin, Texas, California, Colorado, Idaho, and Utah) and nationwide are reviewed here. The health problems most frequently reported at migrant health clinics include dermatitis, injuries, respiratory problems, musculoskeletal ailments (especially back pain), eye problems, gastrointestinal problems, and diabetes. The majority of migrant and seasonal farmworkers and their families seek medical treatment for acute ailments rather than for preventive services or for chronic ailments.

Currently, the only national reporting system that tracks farmworker health data is the Migrant Student Record Transfer System maintained by the Office of Migrant Education, U.S. Department of Education. This computerized system contains the health and academic records of over 700,000 children of migrant farmworkers and fishing workers in the United States and Puerto Rico. Health data that can be entered into these records include results of physical exams, immunization records, dental information, abnormal results of health screening measures such as under- or overweight, positive TB test, anemia, and information on treatment or referrals.

There is, however, no such collection of national health data on adult farmworkers by the federal government, although all clinics that receive federal migrant health funds file a semiannual report, the Bureau of Community Health Services Common Reporting Requirements form (or "BCRR"), with the Office of Migrant Health. These BCRR statistics reflect utilization of services, costs, and clinic personnel, but diagnostic information is not reported. BCRR reports do include numbers of immunizations, hypertension follow-ups, Pap smear follow-ups, adolescent family planning counseling visits, and anemia screenings. A national morbidity reporting system of the 10 most frequently diagnosed health problems at migrant health centers is slated to begin operation at the National Migrant Referral Project, Austin, Texas in 1986 with funding from the Office of Migrant Health.

In this chapter, we summarize farmworker health data collected within the past decade in ten states: Florida, North Carolina, New York, Michigan, Wisconsin, Texas, California, Colorado, Idaho, and Utah. In addition, the results of two multi-state surveys are presented under the subheading "National Data." The data on farmworker health conditions presented here include the results of clinic-based studies, community surveys, and migrant health center patient information (see also Johnston, 1985).

National Data

In 1981, the National Association of Community Health Centers, Inc. (NACHC), Washington, D.C., conducted a survey of clinics receiving federal migrant health funding (under the Public Health Service Act, Title III, Part D, Section 329), at the request of the Office of Primary Care, Bureau of Community Health Services (Hicks, 1982). In one of the questions in this survey, respondents were asked to list the twelve most common diagnoses made in 1979 and 1980 by number of encounters.

Staff from sixty (49%) of the 122 projects responded. Forty percent (40%) of the respondents were from "upstream" projects, those located in northern farm states. The remainder were the "downstream" or "home-base" health centers, which are located in southern California, Texas, and Florida. These clinics are more likely to operate year-round because they are located in those areas where migrants live during the off-season.

Table 1 shows the 13 most frequently cited diagnoses reported by the 42 migrant health centers that supplied diagnostic information. (This information is not age- or sex-specific.) Data collection and analysis were hampered by the fact that many centers did not have these types of diagnostic data compiled or had compiled data for only one of the two years. Although the sample is small, nevertheless, the information is useful in helping to create a national picture of the conditions migrant health centers treat and the differences — if any — between the health conditions for which migrant farmworkers seek care when they are away from home compared to when they are at home.

Almost all of the diagnoses listed in Table 1 have some implications for workplace health. Some health problems are caused or exacerbated by workplace conditions. For example, accidents cause trauma, the lack of toilets and drinking water contribute to the development of urinary tract infections, exposure to pesticides promotes dermatitis, unsanitary working conditions can lead to gastroenteritis, and the stress of working at piece rate (payment per bushel, crate, or bucket picked rather than a straight hourly wage) can influence hypertension. There are other conditions that affect the ability of the worker to perform on the job (e.g., anemia, heart disease, diabetes, obesity). When one considers that children and women, including pregnant and nursing women, also work in the fields, the pediatric and obstetrical diagnostic categories also have important implications for occupational health. The distinctions further blur when one considers that many of the labor camps and housing units for migrant farmworkers are provided by the employer and/or are located adjacent to the fields where pesticides are sprayed, or that other migrant farmworkers are forced to live out in the open (e.g., in the orchards where they work). In these situations, the working and living environments, and thus the workers' exposures to pesticides and other hazards, are one and the same.

NACHC compared the most frequent diagnoses of the "upstream" migrant health centers with those of the home-

TABLE 1
MOST FREQUENT DIAGNOSES AMONG FEDERALLY FUNDED MIGRANT HEALTH CENTERS — 1979 and 1980*

Diagnosis	*No. Times Cited*	*% T#*	*% N§*	*Total No. Encounters***		*1980 / % 1979*	*Rank in Re: No. Encounters*	
				1979	*1980*		*1979*	*1980*
Acute Upper Respiratory Infection	40	66.66	95.24	23,671	30,364	+28.3	3	3
Hypertension	35	58.33	83.33	30,745	32,067	+ 4.3	1	2
Obstetrics	34	56.66	80.95	27,392	36,125	+31.9	2	1
Diabetes Mellitus	27	45.00	64.29	14,526	17,266	+18.9	5	6
Otitis Media	25	41.66	59.52	12,962	17,931	+38.3	6	4
Dermatitis.	21	35.00	50.00	2,846	3,727	+30.95	11	11
Trauma	20	33.33	47.62	3,441	4,132	+20.1	9	10
Urinary Tract Infection .	20	33.33	47.62	9,875	10,705	+ 8.4	7	7
Anemia	13	21.66	30.95	15,772	17,889	+13.4	4	5
Obesity	13	21.66	30.95	3,356	4,322	+28.8	10	9
Gastroenteritis	13	21.66	30.95	2,091	2,594	+24.1	13	13
Family Planning	12	20.00	28.57	3,539	6,827	+92.9	8	8
Heart Disease	11	18.33	26.19	2,220	2,671	+20.3	12	12

*These diagnoses are actual, not groupings of related diagnostic categories. Hicks (1982), p. 20.

**Encounter data was of poor quality. Many Migrant Centers did not have this data. For those reporting data, some had 1979 only, some 1980 only. Several of those reporting data "double counted"—i.e., they reported their encounters in terms of *primary* and *secondary* diagnoses. These data do not include encounters identified by respondents as "double counted." Total number of encounters for all conditions not specified.

#T = total number responding to survey (60).

§N = total number providing some data regarding diagnoses (42).

base centers. (This information is presented in Tables 2 and 3.) The upstream clinics reflected a truer picture of health problems in a migrant population actively involved in agricultural work, while the downstream centers included data on a group with a smaller proportion of migrant farmworkers. The most striking difference between the upstream and downstream health centers was that gastroenteritis and parasitic infections were common diagnoses for the upstream clinics (50% and 39% of them reported these two conditions, respectively) but not for the downstream sites. This difference likely demonstrates the effects of substandard migrant labor camps and/or unsanitary conditions in the fields. The category of dermatitis or skin rashes revealed another notable difference between upstream and downstream sites; in 89% of the upstream clinics dermatitis was reported as one of the most frequent reasons for patient visits versus 43% of downstream sites. (Dermatitis is the most frequently reported occupational disease in agriculture as well as for industries in general.)

The home-base data may more accurately reflect the types of chronic health problems of a population recovering from a season of migratory work or of a population no longer doing farmwork and/or no longer able to travel to northern worksites. On the other hand, the upstream clinic data may illustrate the most bothersome health problems that interfere with the ability to work; these problems may not trigger a doctor's visit if the farmworker is back home and not working in the fields.

NACHC is currently analyzing the results of a similar 1983 survey of its members that asked for a listing of the twenty most common diagnoses in the years 1981 and 1982 (Hicks, 1985).

Trotter (1984) surveyed 109 migrant families in nine states (California, Florida, Illinois, Minnesota, Maryland, Pennsylvania, Texas, and Washington, and Wyoming) regarding their health status and needs for further health information. The survey was part of the efforts of Project HAPPIER (Health Awareness Patterns Preventing Illnesses and Encouraging Responsibility, funded by the U.S. Department of Education) to develop effective health education curricula for migrant children. Although the age distribution and number of working members in these families were not specified in this report, family size ranged from one to fifteen persons, the most common being five family members. The survey was designed to be a proportional random sample.

The families were questioned about both major and minor illnesses that had affected at least one member of the family during the previous twelve months. (Tables 4 and 5 present this data.)

A variety of the major and minor health problems are most likely directly work-related such as sunstroke (9.4%), pesticide poisoning (4.3%), backache (39.8%), cuts (29.7%), rashes (27.9%), and swollen joints (20.6%). Other conditions may be related to workplace conditions or exacerbated by them, e.g., bladder or kidney problems, intestinal parasites, and sores due to a lack of sanitary facilities; eye problems/blurred vision from working in a dusty environment or from exposure to pesticides and/or fertilizers; and

TABLE 2
MOST FREQUENT DIAGNOSES IN UPSTREAM MIGRANT HEALTH CENTERS*

Diagnosis	*% Centers Reporting***
Skin disorders (dermatitis)	89
Upper respiratory infections	72
Hypertension	72
Otitis media	61
Prenatal visits	61
Gastroenteritis	50
Urinary tract infections	39
Diabetes	39
Parasitic infections	39

*Hicks (1982), p. 21.
**N = 18 centers; total number of patient encounters not specified.

TABLE 3
MOST FREQUENT DIAGNOSES IN DOWNSTREAM OR HOME-BASE MIGRANT HEALTH CENTERS*

Diagnosis	*% Centers Reporting***
Upper respiratory infections	100
Hypertension	96
Diabetes mellitus	83
Prenatal visits	74
Otitis media	61
Urinary tract infections	52
Arthritis/rheumatism/bursitis	48
Dermatitis	43
Obesity	39

*Hicks (1982), p. 21.
**N = 23 centers; total number of patient encounters not specified.

TABLE 4
MINOR ILLNESSES/SYMPTOMS REPORTED BY MIGRANT FARMWORKER FAMILIES*

Illness/Symptom	*% Families Reporting Illness***
Colds	65.4
Headaches	63.0
Flu	57.0
Toothache	47.2
Ear problems	43.5
Sore throat	42.1
Backache	39.8
Eye problems	35.2
Coughing	34.0
Allergies	31.4
Fever	31.3
Stomachache	30.8
Cuts	29.7
Diarrhea	28.6
Rashes	27.9
Nervousness	25.9
Colic	25.5
Sinus problems	24.3
Insomnia	22.9
Swollen joints	20.6
Indigestion	20.4
Sores	20.2
Constipation	18.9
Vomiting	18.1
Blurred vision	17.8
Menstrual problems	16.8
Gum problems	15.7
Burns	15.7
Unusual weakness	15.4
Nausea	15.2
Shortness of breath	14.8
Chest pains	14.2
Lack of appetite	14.2
Bladder problems	10.4
Congestion	10.3
Boils	9.4
Large weight loss	6.3
Large lymph nodes	0.0

*Trotter (1984), pp. 17-18.
**N = 109

nervousness, insomnia, and depression due to work stress and migratory way of life.

The families were also questioned about their understanding of the causes of specific maladies, how they dealt with them, their living and working conditions, barriers to seeking medical care, and the health problems for which they wanted further information.

Trotter emphasized the significance of the high frequency of both major and minor illnesses, because if left untreated, even minor illnesses can become debilitating chronic conditions (e.g., ear problems such as otitis media may lead to deafness).

The rest of this section is devoted to the various farmworker health surveys or studies that have been conducted in specific states during the past ten years. The discussion is divided into geographic regions: the East (Florida, North Carolina, and New York), Central states (Michigan, Wisconsin, and Texas), and the West (California, Colorado, Idaho, and Utah).

Eastern States

Florida

In 1973-74, a survey of 65% of the migrant farmworkers in the St. Johns River basin agricultural area of north Florida

TABLE 5
MAJOR ILLNESSES REPORTED BY MIGRANT FARMWORKER FAMILIES*

Illness	*% Families Reporting Illness***
Eye problems	35.2
Depression	23.1
Anemia	21.7
Arthritis	18.9
High blood pressure	16.8
Stillbirth	16.2
Kidney problems	14.8
Obesity	14.3
Problems during pregnancy	13.4
Asthma	12.5
Intestinal parasites	11.3
Deafness	11.2
Heart problems	11.2
Ulcers	9.4
Sunstroke	9.4
Diabetes	7.5
Cancer	4.7
Epilepsy	4.7
Pesticide poisoning	4.3
Liver damage	3.8
Lazy eye	3.8
Tuberculosis	3.8
Infertility	3.2
Sickle cell anemia	2.9
Alcoholism	1.9
Polio	0.9
Gonorrhea**	0.0
Syphilis**	0.0

*Trotter (1984), pp. 18-19; N = 109.

**Almost 46% of the families surveyed indicated an interest in learning more about these diseases. Given this interest and the frequency with which such cases are reported by migrant health clinics, it can be assumed that these diseases are underreported.

was conducted; in the survey, 291 heads of household, representing a total of 552 people were queried (Bleiweis et al., 1977). The farmworkers were asked about their own and their families' health and about their use of professional health care services and facilities. Over 90% of the respondents were black; 76% were male. They were interviewed in their homes in town or in the labor camps.

Most migrant farmworkers in the survey reported receiving health care at the two area migrant health clinics. Their most frequently cited acute health problems included respiratory illnesses, digestive problems, injuries, and musculoskeletal problems. The most common chronic conditions reported were heart disease and hypertension, musculoskeletal disorders, digestive problems, and genitourinary problems. Little use was made of dental services, except for tooth extractions. The two major factors that affected their utilization of health services were an acute medical condition and their perception of being generally in poor health. Factors that typically have been thought of as impediments to seeking health care, such as lack of transportation, the presence of children in the household, and the absence of education, were not important considerations for this population.

Unfortunately, this survey did not include workers in central and southern Florida, where the heaviest — and predominantly Hispanic — migrant farmworker population can be found. In addition, no comparison was made with a non-migrant or non-farmworker population of the area.

North Carolina

In 1981, the North Carolina Student Rural Health Coalition surveyed 205 migrant and seasonal farmworker patients at the Tri-County Community Health Center, Newton Grove, about their work-related health problems (Ehrlich and Hardgrave, 1981). About two-thirds (68%) of those interviewed were black Americans, almost 20% were Mexican-American, 8% white, and 4% were Haitian or Jamaican.

Sixty-five percent (65%) of the farmworkers interviewed reported having suffered some type of occupational illness or injury during their career in farmwork. Skin problems afflicted 42% of the farmworkers and were the most commonly reported health condition; they accounted for 66% of the total number of health problems. Dermal problems can result from pesticide exposure or an allergic reaction to certain crops (e.g., green tobacco sickness).

The next most common occupational health problems were symptoms of acute poisoning after exposure to agricultural chemicals. Forty percent (40%) of the study participants had experienced some type of adverse reaction after exposure to pesticides, although only six cases of pesticide poisoning were officially reported. (These were cases of more serious acute symptoms, such as fainting or chest pains, which required hospitalization.) Most of the more mild reactions had resulted in symptoms such as headache, dizziness, and nausea.

The authors stated that other occupational problems also were frequently reported: cuts, sprains, injuries from machines and tractors, back problems, and insect bites. Green tobacco sickness, a form of nicotine poisoning caused by skin absorption of certain substances in tobacco in wet fields, was also a common problem.

This survey did not include a review of patient medical records. The study population was not a random sample, and no control group was used for comparison.

New York

A report on the demographics, health care needs, and economic impact of migrant farmworkers in upstate New York (State University of New York at Buffalo, 1984) involved a review of all 1983 patient medical records of Oak Orchard Community Health Center (Brockport). These data included 910 encounters with 466 patients, some of the findings of which are described below:

(1) Children under 16 years of age came to the health center primarily for treatment of symptoms of an acute medical

condition such as upper respiratory infections (15%) and otitis media (13%).

(2) Ten percent (10%) of all clinic visits by migrant farmworkers who were at least 16 years of age were for general medical or prenatal exams.

(3) The two most frequent symptoms for which migrant farmworkers 16 years of age and older sought care were skin rashes and back problems.

(4) Migrants did not seek care for such health problems as teeth and gum ailments and vision dysfunctions.

In addition to a review of patient records, this study included a random sample survey of 453 migrant farmworkers in the labor camps, who were asked about their perceived health needs. Although both family and solo respondents (i.e., single people or those unaccompanied by their family) generally saw their health as good (and 34% of family respondents thought that their families were in excellent health), one-third of the solo respondents and about one-half of the family respondents had at least one health problem. The leading health conditions, which affected 20-25% of the migrant farmworkers, were back and musculoskeletal problems. Women were more likely than men to be affected by a health problem. Among solo farmworkers a larger proportion (54%) of American blacks — more than of any other ethnic group — suffered from a health problem of some kind.

The migrant farmworker population in this study was diverse: Mexican Americans, American blacks, Haitians, Jamaicans, and Puerto Ricans accounted for at least 90% of both family and solo respondents. Sixty-five percent (65%) of the family respondents were female, and 95% of the solo respondents were male.

It should be noted that a medical records review combined with a community survey provides information on both users and non-users of health services and is a methodology that should be used more often.

Central States

Michigan

The Migrant and Rural Community Health Association (MARCHA) in Bangor, Michigan compared the ten most frequent diagnoses encountered in 1978 in their migrant farmworker and non-migrant patient populations. What portion — if any — of the "non-migrants" also do farmwork, e.g., farmers or seasonal farmworkers, is not specified. (These results are shown in Table 6.)

More specific information on the total number of encounters or number of patients, age distribution of the patients, and percentages for the specific complaints was not available. Nonetheless, it is evident from this data that, among migrant farmworkers, maternal-child health concerns (i.e., prenatal visits, otitis media, diarrhea, and, most probably, upper respiratory tract infections) are major reasons for clinic visits. In addition, a common occupational complaint of agricultural workers — dermatitis — is the sixth most frequently made diagnosis among the migrant farmworker patients.

TABLE 6
MOST FREQUENT DIAGNOSES
MARCHA HEALTH CENTER DATA — 1978*

	Migrants	*Non-Migrants*
1.	Upper respiratory infections - respiratory problems - flu	Hypertension
2.	Prenatal	Upper respiratory infections - respiratory problems - flu
3.	Otitis media	Diabetes
4.	Hypertension	Arthritis
5.	Diabetes	Bronchitis
6.	Dermatitis	Urinary tract infection
7.	Obesity	Anxiety
8.	Gastroenteritis	Obesity
9.	Urinary tract infection	Abdominal pain
10.	Diarrhea	Gastritis

*Unpublished data provided by Mrs. Jane Miller, R.N., M.S.N., Director of Primary Care, MARCHA, P.O. Box 130, Bangor, MI 49013, phone: 616-427-7937. N is not specified.

The Sparta Health Center in Sparta, Michigan, in conjunction with Michigan State University compared by age and sex the medically diagnosed conditions of their migrant farmworker versus non-migrant patients treated during the summer and fall of 1979. There were a total of 10,017 medical and supplemental health situations (such as prenatal care, pregnancy testing, and immunizations). The total number of patients represented by these data was not known due to precautions taken to preserve confidentiality of patient records. It is not known how many of the patients in the non-migrant patient group were also agricultural workers (i.e., seasonal farmworkers or farmers).

Of the 10,017 conditions, there were 6,640 observed among the female patients and 3,377 among the males. Among non-migrants, there were 8,496 observed conditions (5,813 medical conditions and 2,683 supplementary health situations). Among migrants, there were 1,521 observed conditions (1,229 medical conditions and 292 supplementary health situations). The diagnoses were coded according to the *International Classification of Health Problems in Primary Care*, Second Edition.

The distribution of medically diagnosed conditions by age group differed significantly between the migrant farmworker and non-migrant patients. The migrant diagnoses were more highly concentrated among the young and women of child-bearing age than were the non-migrant diagnoses: 68.3% of the conditions seen in the migrant farmworker group were found in women of child-bearing age and children under the age of four whereas 51.5% of the medical diagnoses were found in these same age groups within the non-migrant patient group. In addition, migrants had almost twice as many of their diagnoses in the 0-14-year-old group compared to the non-migrant patients (42.3% versus 24.4%). Adults between the ages of 15-44 years

TABLE 7
SPECIFIC DIAGNOSES AS A PERCENTAGE OF ALL DIAGNOSED MEDICAL CONDITIONS SEEN IN EACH PATIENT GROUP

CONDITIONS SEEN MORE OFTEN IN MIGRANT FARMWORKERS*

*Code***	*Diagnosis*	*Migrant Percent*	*Non-Migrant Percent*
I - 2	Presumed Infectious Intestinal Disease	5.3	0.3
VIII - 133	Acute Upper Respir. Tract Infection	24.9	12.6
VI - 103	Eustachian Block or Catarrh	3.7	1.0
VIII - 135	Acute Tonsillitis & Quinsy	2.5	0.5
XVI - 274	Nausea/Vomiting	1.8	0.3
VI - 101	Acute Otitis Media	8.1	4.5
VI - 92	Conjunctivitis & Ophthalmia	3.2	1.4
XII - 210	Impetigo	2.3	0.9
VI - 106	Wax in Ear	1.9	0.8
II - 46	Neoplasm NYD Benign or Malignant***	1.0	0.5
XIII - 239	Back Pain with Radiating Symptoms	1.1	0.5

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
Migrant N = 1,229 medical conditions.
Non-migrant N = 5,813 medical conditions.
****International Classification of Health Problems in Primary Care*, Second Edition.
***NYD = Not yet diagnosed.

TABLE 8
SPECIFIC DIAGNOSES AS A PERCENTAGE OF ALL DIAGNOSED MEDICAL CONDITIONS SEEN IN EACH PATIENT GROUP

CONDITIONS SEEN MORE OFTEN IN NON-MIGRANTS*

*Code***	*Diagnosis*	*Migrant Percent*	*Non-Migrant Percent*
VII - 120	Hypertension, Uncomplicated	2.1	8.5
V - 72	Depressive Disorder	0.2	4.7
III - 55	Obesity	1.5	5.0
III - 50	Diabetes Mellitus	2.7	6.3
I - 19	Warts, All Sites	0.5	2.4
XIII - 233	Other Bursitis & Synovitis	0.2	1.5
VIII - 145	Hay Fever	0.4	1.9
VIII - 143	Emphysema & COPD***	0.4	1.4
XVII - 323	Lacerat/Open Wound/Traum Amputan	1.4	2.6
I - 20	Viral Infections NOS***	0.6	1.5
X - 185	Vaginitis NOS, Vulvitis***	1.1	2.3
XIII - 238	Back Pain w/o Radiating Symptoms	1.9	3.1
XIII - 229	Osteoarthritis & Allied Conditions	1.1	2.1
VIII - 138	Bronchitis & Bronchiolitis, Acute	2.1	3.2

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
Migrant N = 1,229 medical conditions.
Non-migrant N = 5,813 medical conditions.
****International Classification of Health Problems in Primary Care*, Second Edition.
***COPD = Chronic obstructive pulmonary disease.
NOS = Not otherwise specified.

accounted for 52.1% of the diagnosed conditions among the non-migrants compared to 48.3% among the migrants. In the 45-and-over age bracket, non-migrants accounted for 23.5% of the conditions compared to only 9.5% among the migrant farmworker patients. Very few diagnosed conditions were registered for migrants in the over-65 age group.

Table 7 lists those medical conditions for which migrants sought care significantly more often than non-migrants. Seven of these eleven conditions are communicable diseases (or suggest the possibility of contagion, e.g., nausea/vomiting, catarrh) and account for over 40% of all diagnosed medical conditions among the migrant farmworker group.

Table 8 presents a list of the medical diagnoses found significantly more frequently among the non-migrant patients. In contrast to the migrant farmworker patients, who, for the most part, had acute conditions, the non-migrant group's most frequent diagnoses were mainly chronic conditions. This difference may be explained by various factors: this migrant farmworker patient population is younger than the non-migrant patient population and thus overall are more likely to suffer acute rather than chronic conditions; fewer farmworkers with chronic health conditions do migrant farmwork; migrants of all ages are at increased risk of acute disease; migrants with chronic conditions may not seek medical care while working up north; and/or migrants with chronic conditions in general do not see a physician as often as non-migrants.

Tables 7 and 8 do not reflect age and sex differences between the two populations; however, the Sparta Health Center did compare the ranking order of the medical and supplemental health conditions by age group (i.e., less than one year of age, 1-4 years, 5-14, 15-24, 25-44, and 45-64). This information is presented in Tables 9-14.

Table 9 reveals a striking difference between the migrant and non-migrant patients less than a year old: whereas the primary reason for non-migrant patient visits was a routine medical check-up (58%), the two most common reasons for migrant infant visits were communicable diseases, acute upper respiratory tract infections (35%) and unspecified infectious intestinal diseases (17%). By contrast, *only 1%* of non-migrant infant diagnoses were for infectious intestinal disease. Immunizations accounted for 5% of the non-migrant baby but only 1.4% of the migrant infant visits. Reasons for this difference may be that infants of migrant farmworkers are immunized when families are at home rather than during migration or that this group overall is under-immunized.

As shown in Table 10, the same trends continue in the 1-4 year age group. The principal reason for a clinic visit for non-migrant children was still a medical exam (34%), but *less than 1%* of the migrant child visits in this age group were for a routine medical check-up. Acute upper respiratory tract infections (38%), acute otitis media (17%), and infectious intestinal diseases (6.5%) were the major reasons for their visits. These three complaints accounted for half as many diagnoses among the non-migrant children (30% versus 62%). In this study, anemia did not appear to be a major health problem among the migrant farmworker children, although other studies (Chase et al., 1971; Kaufman et al., 1973) have shown it to be prevalent.

In the 5-14 year age group (Table 11), almost one-third (31%) of the migrant diagnoses were acute upper respiratory tract infections, almost three times the rate of the non-migrant group (12%). About 7% of the visits by migrant children were for check-ups, while three times that rate was registered for the non-migrant group (22%). Conjunctivitis (6%) and infectious intestinal diseases (4%) were ranked third and fourth for migrant farmworker children. These complaints ranked eighteenth (1.6%) and zero (0%), respectively, among the non-migrants. Acute otitis media was a slightly more frequent diagnosis among the non-migrant children (6% of health problems) compared to the migrant farmworker children (4.5% of health problems). There also was an eight-fold difference between these groups in the frequency of immunizations, accounting for 4.4% among non-migrants versus 0.6% among migrant children. Across all age groups, however, no statistically significant difference was seen between the two groups in the number of visits for immunizations.

Table 12 features the comparison between the groups aged 15-24, in which the ten most common diagnoses of the migrant farmworker and non-migrant groups are more similar. Prenatal care was the primary reason for clinic visits among both migrants and non-migrants, accounting for 21% of all conditions in both groups. Clinic visits to obtain oral contraceptives were more common among the migrant farmworker population, as were visits for counseling for marital problems. About 15% of the non-migrant visits were for medical exams, whereas check-ups accounted for only 5% of the migrant farmworker visits. Diabetes mellitus ranked eighth (3.8%) among the migrant group and thirtieth among non-migrants (0.6%), an over six-fold difference.

In the 15-24-year-old group, acute tonsillitis, nausea/vomiting, intestinal infectious diseases, and impetigo were at least four times more frequent among the migrant farmworker patients. Newly discovered tumors (neoplasms) accounted for almost 1% of the migrant visits compared to 0.4% of the non-migrant visits.

As Table 13 reveals, more differences appear in the 25-44-year-old group. Within this age group, prenatal care was the most frequent diagnosis among migrant farmworker patients and the second most common among the non-migrant patients. Medical examination was the principal reason for a clinic visit among the non-migrants, being cited two and a half times more frequently by that group. Only four of the ten most common diagnoses were the same for both migrants and non-migrants (although not in the same order). The following conditions were reported two to three times as often among these migrant farmworker patients: anxiety neurosis, dermatitis, conjunctivitis, and osteoarthritis. Nausea and vomiting were five times as frequent a complaint among the migrant patients.

In this age group, newly found tumors were almost five times more frequent among the migrants, accounting for 2.2% of their visits versus 0.46% of the non-migrant visits.

On the other hand, although infectious intestinal diseases, impetigo, and emphysema accounted for less than one-half of one percent of the migrant diagnoses, they occurred four to twelve times more frequently in these migrant farmworker patients as compared to the 25-44-year-old non-migrant patient group.

In Table 14 the diagnoses for the two 45-64-year-old age groups are compared. The most frequent diagnoses for both groups were hypertension and diabetes. Anxiety neurosis, acute bronchitis, elevated blood pressure without hypertension, contact dermatitis, bruises, conjunctivitis, rash, and vertebral sprain-strain were diagnosed two to three times as frequently in the migrant farmworker group. Back pain without radiation and eustachian block were reported over four times as frequently as the reason for clinic visits by the 45-64 year-old migrant farmworker group compared to the non-migrants. Infectious intestinal diseases accounted for almost 3% of migrant farmworker diagnoses in this age group and only 0.08% of the non-migrant diagnoses, a 36-fold difference in the rates of the two patient groups.

The non-migrant rate among 45-64-year-olds for diagnoses of obesity-related problems was five times higher than the migrant farmworker rate. Depressive neurosis and bursitis were cited three times as frequently in the non-migrant group.

TABLE 9
COMPARISON OF RANK ORDER LISTINGS OF 19 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age: Less Than One Year

*Code***	*Primary Care Diagnosis*	*Migrant*		*Non-Migrant*	
		Pct.	*Rank*	*Rank*	*Pct.*
P133	Acute Upr Resp Tract Infection	34.97	1	2	10.93
P002	Intestinal Dis Infec, Unspec	17.48	2	11	1.21
P338	Medical Examination	10.49	3	1	58.10
P101	Acute Otitis Media	9.79	4	3	6.28
P092	Conjunctivitis	4.20	5	5	2.83
P210	Impetigo	3.50	6	8	1.62
P300	Other Symptoms, Ill-Def Cond	3.50	7	10	1.42
P135	Acute Tonsillitis, Quinsy	2.80	8	15	0.61
P138	Acute Bronchitis-Bronchiolitis	2.80	9	17	0.40
P100	Otitis Externa	1.40	10	13	0.61
P106	Wax in Ear	1.40	11	—	—
P214	Contact-Other Dermatitis	1.40	12	6	2.23
P274	Nausea, Vomiting	1.40	13	18	0.40
P340	Prophylactic Immunization	1.40	14	4	4.86
P019	Warts All Sites	0.70	15	21	0.20
P103	Eustachian Block	0.70	16	14	0.61
P116	Heart Murmur NEC, NYD***	0.70	17	24	0.20
P279	Abdominal Pain	0.70	18	19	0.40
P327	Bruise, Contusion, Crushing	0.70	19	16	0.61

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
Migrant N includes 143 medically diagnosed conditions; non-migrant N includes 494

***International Classification of Health Problems in Primary Care*, Second Edition

***NEC = Not elsewhere classified
NYD = Not yet diagnosed

TABLE 10
COMPARISON OF RANK ORDER LISTINGS OF 25 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age = 1-4 Years

*Code***	*Primary Care Diagnosis*	*Migrant*		*Non-Migrant*	
		Pct.	*Rank*	*Rank*	*Pct.*
P133	Acute Upr Resp Tract Infection	38.39	1	2	17.17
P101	Acute Otitis Media	17.34	2	3	13.39
P002	Intestinal Dis Infec, Unspec	6.50	3	29	0.16
P103	Eustachian Block	4.95	4	19	0.94
P092	Conjunctivitis	4.33	5	6	2.68
P210	Impetigo	4.33	6	11	2.05
P135	Acute Tonsillitis, Quinsy	4.02	7	23	0.47
P106	Wax in Ear	3.72	8	32	0.16
P100	Otitis Externa	2.79	9	14	1.26
P170	Cystitis, Urinary Infec NOS***	1.55	10	5	2.99
P274	Nausea, Vomiting	1.55	11	34	0.16
P292	Rash, Other Skin Eruptions	1.55	12	13	1.42
P323	Laceration, Open Wound	1.55	13	4	3.46
P020	Viral Infection NOS***	0.93	14	9	2.05
P116	Heart Murmur NEC, NYD***	0.93	15	10	2.05
P207	Boil, Cellulitis, Abscess	0.93	16	20	0.79
P338	Medical Examination	0.93	17	1	34.17
P138	Acute Bronchitis-Bronchiolitis	0.62	18	16	1.10
P185	Vaginitis NOS***	0.62	19	21	0.63
P317	Sprain-Strain Ankle	0.62	20	0	0
P327	Bruise, Contusion, Crushing	0.62	21	15	1.26
P120	Hypertension Uncomplicated	0.31	22	0	0
P214	Contact-Other Dermatitis	0.31	23	7	2.20
P279	Abdominal Pain	0.31	24	35	0.16
P288	Joint Pain, Arthralgia	0.31	25	0	0

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831. Migrant N includes 323 medically diagnosed conditions; non-migrant N includes 535.

***International Classification of Health Problems in Primary Care*, Second Edition.

***NOS = Not otherwise specified
NEC = Not elsewhere classified
NYD = Not yet diagnosed

TABLE 11
COMPARISON OF RANK ORDER LISTINGS OF 35 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age = 5-14 Years

*Code***	*Primary Care Diagnosis*	*Migrant*		*Non-Migrant*	
		Pct.	*Rank*	*Rank*	*Pct.*
P133	Acute Upr Resp Tract Infec	31.07	1	2	12.22
P338	Medical Examination	6.78	2	1	22.00
P092	Conjunctivitis	5.21	3	18	1.59
P002	Intestinal Dis Infec, Unspec	4.52	4	0	0
P101	Acute Otitis Media	4.52	5	3	6.06
P103	Eustachian Block	3.95	6	30	0.53
P135	Acute Tonsillitis, Quinsy	3.95	7	26	0.96
P207	Boil, Cellulitis, Abscess	3.95	8	10	2.76
P116	Heart Murmur NEC, NYD***	3.39	9	16	1.70
P210	Impetigo	2.82	10	12	2.66
P262	Chest Pain	2.26	11	37	0.21
P279	Abdominal Pain	2.26	12	11	2.76
P323	Laceration, Open Wound	2.26	13	4	5.31
P327	Bruise, Contusion, Crushing	2.26	14	7	3.51
P106	Wax In Ear	1.69	15	34	0.43
P214	Contact - Other Dermatitis	1.69	16	13	2.13
P274	Nausea, Vomiting	1.69	17	44	0.11
P020	Viral Infection NOS***	1.13	18	17	1.59
P100	Otitis Externa	1.13	19	23	1.17
P138	Acute Bronchitis-Bronchiol	1.13	20	15	1.81
P145	Hayfever, Allergic Rhinitis	1.13	21	8	3.40
P170	Cystitis, Urinary Infec NOS	1.13	22	14	1.91
P288	Joint Pain, Arthralgia	1.13	23	24	1.17
P292	Rash, Other Skin Eruptions	1.13	24	21	1.28
P295	Malaise, Fatigue, Tiredness	1.13	25	27	0.74
P055	Obesity	0.56	26	19	1.49
P070	Anxiety Neurosis	0.56	27	33	0.43
P185	Vaginitis NOS***	0.56	28	42	0.11
P238	Back Pain No Radiation	0.56	29	43	0.11
P300	Other Symptoms, Ill-Def Cond	0.56	30	28	0.74
P317	Sprain-Strain Ankle	0.56	31	22	1.28
P340	Prophylatic Immunization	0.56	32	6	4.36
P350	Diagnosis of Pregnancy	0.56	33	29	0.64
P359	Marital Problem, Exc Sex	0.56	34	39	0.21
P360	Parent-Child Problem	0.56	35	9	3.29

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831. Migrant N includes 177 medically diagnosed conditions; non-migrant N includes 941.

***International Classification of Health Problems in Primary Care*, Second Edition.

***NOS = Not otherwise specified; NEC = Not elsewhere classified; NYD = Not yet diagnosed.

TABLE 12
COMPARISON OF RANK ORDER LISTINGS OF 39 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age = 15-24 Years

Code**	Primary Care Diagnosis	*Migrant*		*Non-Migrant*	
		Pct.	*Rank*	*Rank*	*Pct.*
P351	Prenatal Care	21.54	1	1	21.39
P133	Acute Upr Resp Tract Infec	10.46	2	3	10.75
P350	Diagnosis of Pregnancy	7.38	3	4	4.67
P279	Abdominal Pain	4.92	4	8	2.71
P338	Medical Examination	4.92	5	2	14.50
P344	Oral Contraceptive	4.92	6	22	1.19
P170	Cystitis, Urinary Infec NOS***	4.00	7	5	3.69
P050	Diabetes Mellitus	3.83	8	30	0.60
P359	Marital Problem Exc Sex	3.38	9	39	0.43
P103	Eustachian Block	3.08	10	21	1.19
P101	Acute Otitis Media	2.46	11	16	1.36
P055	Obesity	2.15	12	17	1.25
P185	Vaginitis NOS***	2.15	13	7	3.04
P214	Contact-Other Dermatitis	2.15	14	11	2.01
P135	Acute Tonsillitis, Quinsy	1.85	15	41	0.33
P274	Nausea, Vomiting	1.85	16	50	0.05
P100	Otitis Externa	1.54	17	23	1.09
P295	Malaise, Fatigue, Tiredness	1.54	18	26	0.92
P323	Laceration, Open Wound	1.54	19	13	1.74
P002	Intestinal Dis Infec, Unspec	1.23	20	45	0.22
P070	Anxiety Neurosis	1.23	21	20	1.19
P138	Acute Bronchitis-Bronchiolitis	1.23	22	10	2.01
P238	Back Pain No Radiation	1.23	23	9	2.55
P354	Advice, Health Instruction	1.23	24	14	1.63
P046	Neoplasm NYD Benign Malig***	0.92	25	40	0.38
P210	Impetigo	0.92	26	46	0.22
P292	Rash, Other Skin Eruptions	0.92	27	32	0.60
P300	Other Symptoms, Ill-Def Cond	0.92	28	42	0.33
P019	Warts All Sites	0.62	29	6	3.47
P145	Hayfever, Allergic Rhinitis	0.62	30	18	1.25
P256	Dizziness, Giddiness	0.62	31	38	0.43
P317	Sprain-Strain Ankle	0.62	32	36	0.49
P340	Prophylactic Immunization	0.62	33	34	0.54
P092	Conjunctivitis	0.31	34	31	0.60
P207	Boil, Cellulitis, Abscess	0.31	35	19	1.25
P262	Chest Pain	0.31	36	44	0.27
P288	Joint Pain, Arthralgia	0.31	37	29	0.71
P320	Sprain-Strain Vertebral	0.31	38	28	0.87
P327	Bruise, Contusion, Crushing	0.31	39	12	1.90

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831. Migrant N includes 325 medically diagnosed conditions; non-migrant N includes 1,842.

***International Classification of Health Problems in Primary Care*, Second Edition.

***NEC = Not elsewhere classified; NYD = Not yet diagnosed.

TABLE 13
COMPARISON OF RANK ORDER LISTINGS OF 47 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age = 25-44 Years

Code**	Primary Care Diagnosis	*Migrant*		*Non-Migrant*	
		Pct.	*Rank*	*Rank*	*Pct.*
P351	Prenatal Care	14.67	1	2	10.79
P133	Acute Upr Resp Tract Infec	9.05	2	3	7.47
P170	Cystitis, Urinary Infect NOS***	4.89	3	10	2.94
P338	Medical Examination	4.89	4	1	12.15
P279	Abdominal Pain	4.65	5	11	2.51
P070	Anxiety Neurosis	4.16	6	17	1.86
P238	Back Pain No Radiation	3.67	7	8	3.17
P207	Boil, Cellulitis, Abscess	3.42	8	28	1.20
P214	Contact-Other Dermatitis	3.18	9	26	1.35
P101	Acute Otitis Media	2.69	10	18	1.86
P103	Eustachian Block	2.69	11	37	0.66
P327	Bruise, Contusion, Crushing	2.69	12	13	2.28
P046	Neoplasm NYD Benign Malignant***	2.20	13	40	0.46
P055	Obesity	2.20	14	5	4.76
P239	Back Pain with Radiation	2.20	15	42	0.39
P350	Diagnosis of Pregnancy	2.20	16	12	2.48
P050	Diabetes Mellitus	1.96	17	9	3.06
P320	Sprain-Strain Vertebral	1.96	18	32	0.89
P288	Joint Pain Arthralgia	1.71	19	22	1.47
P344	Oral Contraceptive	1.71	20	45	0.31
P092	Conjunctivitis	1.47	21	36	0.74
P106	Wax in Ear	1.47	22	38	0.62
P119	Elevated BP w/o Hypertension	1.47	23	31	0.89
P229	Osteoarthritis, Allied Cond	1.47	24	39	0.54
P262	Chest Pain	1.47	25	27	1.32
P274	Nausea, Vomiting	1.47	26	44	0.31
P360	Parent-Child Problem	1.47	27	20	1.55
P256	Dizziness, Giddiness	1.22	28	35	0.77
P295	Malaise, Fatigue, Tiredness	1.22	29	23	1.43
P120	Hypertension Uncomplicated	0.98	30	6	4.14
P138	Acute Bronchitis-Bronchiolitis	0.98	31	7	3.21
P292	Rash, Other Skin Eruptions	0.98	32	41	0.46
P359	Marital Problem Exc Sex	0.98	33	15	2.05
P185	Vaginitis NOS***	0.73	34	14	2.09
P317	Sprain-Strain Ankle	0.73	35	30	0.97
P323	Laceration, Open Wound	0.73	36	24	1.43
P002	Intestinal Dis Infec, Unspec	0.49	37	50	0.04
P019	Warts All Sites	0.49	38	33	0.85
P020	Viral Infection NOS ***	0.49	39	29	7.12
P100	Otitis Externa	0.49	40	16	2.01
P143	Emphysema, COPD, COLD***	0.49	41	48	0.12
P210	Impetigo	0.49	42	49	0.12
P354	Advice, Health Instruction	0.49	43	19	1.62
P116	Heart Murmur NEC, NYD***	0.24	44	43	0.35
P135	Acute Tonsillitis, Quinsy	0.24	45	46	0.27
P233	Bursitis, Synovit Exc Shoulder	0.24	46	21	1.51
P340	Prophylactic Immunization	0.24	47	47	0.23

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
Migrant N includes 409 medically diagnosed conditions; non-migrant N includes 2,585.

***International Classification of Health Problems in Primary Care*, Second Edition.

***NOS = Not otherwise specified
NYD = Not yet diagnosed
COPD = Chronic obstructive pulmonary disease
COLD = Chronic obstructive lung disease

TABLE 14
COMPARISON OF RANK ORDER LISTINGS OF 35 DIAGNOSES AND SUPPLEMENTAL SERVICES FOR MIGRANTS AND NON-MIGRANTS*

Age = 45-64 Years

Code**	Primary Care Diagnosis	Migrant Pct.	Migrant Rank	Non-Migrant Rank	Non-Migrant Pct.
P120	Hypertension Uncomplicated	13.57	1	1	16.59
P050	Diabetes Mellitus	10.00	2	2	12.36
P070	Anxiety Neurosis	7.86	3	8	3.03
P138	Acute Bronchitis-Bronchiol.	7.14	4	15	1.91
P119	Elevated BP w/o Hyperten	6.43	5	11	2.71
P229	Osteoarthritis, Allied Cond	5.71	6	7	3.59
P133	Acute Upr Resp Tract Infec	4.29	7	6	3.99
P239	Back Pain with Radiation	3.57	8	28	0.80
P002	Intestinal Dis Infec, Unspec	2.86	9	45	0.08
P170	Cystitis, Urinary Infection, NOS***	2.86	10	17	1.52
P207	Boil, Cellulitis, Abscess	2.86	11	20	1.36
P214	Contact-Other Dermatitis	2.86	12	18	1.44
P327	Bruise, Contusion, Crushing	2.86	13	19	1.44
P072	Depressive Neurosis	2.14	14	5	5.98
P143	Emphysema, COPD, COLD***	2.14	15	9	2.95
P238	Back Pain No Radiation	2.14	16	10	2.87
P279	Abdominal Pain	2.14	17	12	2.31
P288	Joint Pain, Arthralgia	2.14	18	14	1.99
P055	Obesity	1.43	19	4	7.50
P100	Otitis Externa	1.43	20	24	1.04
P101	Acute Otitis Media	1.43	21	26	0.88
P256	Dizziness, Giddiness	1.43	22	22	1.20
P262	Chest Pain	1.43	23	16	1.59
P359	Marital Problem Exc Sex	1.43	24	30	0.72
P019	Warts All Sites	0.71	25	37	0.32
P092	Conjunctivitis	0.71	26	42	0.24
P103	Eustachian Block	0.71	27	44	0.16
P145	Hayfever, Allergies, Rhinitis	0.71	28	31	0.56
P185	Vaginitis NOS***	0.71	29	27	0.58
P233	Bursitis, Synovit Exc Shld	0.71	30	13	2.15
P292	Rash, Other Skin Eruptions	0.71	31	40	0.32
P300	Other Symptoms, Ill Def Cond	0.71	32	21	1.28
P320	Sprain-Strain Vertebral	0.71	33	43	0.24
P340	Prophylactic Immunization	0.71	34	32	0.48
P351	Prenatal Care	0.71	35	36	0.40

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831. Migrant N includes 140 medically diagnosed conditions; non-migrant N includes 1,254.

***International Classification of Health Problems in Primary Care*, Second Edition.

***NOS = Not otherwise specified; COPD = Chronic obstructive pulmonary disease; COLD = Chronic obstructive lung disease.

Overall, comparisons by age group between these two patient populations revealed the following patterns:

(1) Treatment for acute conditions (i.e., upper respiratory tract infections, infectious intestinal disorders, otitis media, and conjunctivitis) was the main reason for clinic visits by migrant infants and children. For non-migrants in these age groups (0-14 years), routine medical check-ups constituted the principal reason for seeking health care.

(2) The 15-24-year-old group showed the greatest similarity in most frequent diagnoses.

(3) The primary preventive health service used by migrant farmworkers was prenatal care, which ranked first in the 15-24 and 25-44 year groups.

(4) Although "acute respiratory tract infection" was one of the seven most common diagnoses for all age groups of both migrants and non-migrants, rates for migrant farmworkers were two to three times higher in the less-than-one-year, 1-4, 5-14, and 25-44-year-old age groups compared to the non-migrants.

(5) "Unspecified infectious intestinal diseases" accounted for a much higher percentage of diagnoses in the migrant as opposed to non-migrant population (by age group):

Age Group	*% Migrant Diagnoses*	*% Non-migrant Diagnoses*	*Ratio M:NM*
Less than one year . . .	17.48	1.21	14.4
1-4 years.	6.50	0.16	40.6
5-14 years. . . .	4.52	0	∞
15-24 years. . .	1.23	0.22	5.6
25-44 years. . .	0.49	0.04	12.2
45-64 years. . .	2.86	0.08	35.7

(6) Newly diagnosed tumors (neoplasms) were almost two and a half times more frequent among the 15-24-year-old migrant farmworker patient group than among their non-migrant counterparts (0.92% versus 0.38% of the diagnoses). In the 25-44 age group, newly found neoplasms accounted for 2.2% of the diagnoses among migrant patients but only 0.46% among the non-migrants, an almost fivefold difference. The role of occupational exposures such as pesticides should be explored.

(7) Six of the ten most frequent diagnoses for migrants 45-64 years of age were for chronic conditions; however, acute conditions (i.e., acute bronchitis, acute upper respiratory tract infection, infectious intestinal disease, and urinary tract infection) ranked in frequency fourth, seventh, ninth, and tenth, respectively. Non-migrants in this age group had only one acute condition, acute upper respiratory tract infections, in their list of ten most frequent diagnoses.

TABLE 15
COMPARISON OF MIGRANT AND NON-MIGRANT CLINIC PATIENTS IN 20 MOST FREQUENTLY OBSERVED CONDITIONS (APPROX. 75% OF ALL CONDITIONS)*

FEMALE — ALL AGES

Migrants	
002	Infectious Intestinal Disease, Unspecified
103	Eustachian Block
092	Conjunctivitis
**344	Oral Contraceptive
**207	Boils, Cellulitis, Abscess
106	Wax in ear
210	Impetigo
**274	Nausea, Vomiting
Non-Migrants	
**185	Vaginitis, not otherwise specified
**238	Backpain no radiation
**327	Bruises, Contusions, Crushing
**120	Hypertension Uncomplicated
**229	Osteoarthritis, Allied Conditions
**072	Depressive Neurosis
019	Warts, All sites

*Unpublished data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
International Classification of Health Problems in Primary Care, Second Edition.
Migrant N = 993
Non-migrant N = 5,647
**Not found in male population

The Sparta study also compared the most frequently observed conditions of the migrant and non-migrant groups by sex. (This information is shown in Tables 15-17.) Once again, it can be seen that the migrant farmworker patients of both sexes sought treatment for more acute, communicable conditions, while the non-migrant patients had conditions that were of a more chronic nature. (The age distribution of the populations is one factor that contributes to this difference.)

Infectious intestinal disease, conjunctivitis, and impetigo all were frequent complaints of the migrant group. These conditions, it should be noted, are caused or exacerbated by poor sanitation — be it in the home or the workplace.

Given the limited means of migrant and seasonal farmworkers — their 1981 average annual incomes were $3,995 and $4,081 respectively (Pollack and Jackson, 1983), the more pressing needs of food and housing, the problems of access to medical care, and the loss of wages when workers take time off to see a doctor, it is easy to see why these workers and their families visited clinics for preventive services or for treatment of chronic conditions less often than the general population.

TABLE 16
COMPARISON OF MIGRANT AND NON-MIGRANT CLINIC PATIENTS IN 20 MOST FREQUENTLY OBSERVED CONDITIONS (APPROX. 75% OF ALL CONDITIONS)*

MALE — ALL AGES

Migrants	
002	Infectious Intestinal Diseases Unspecified
103	Eustachian Block
**135	Acute Tonsillitis, Quinsy
092	Conjunctivitis
210	Impetigo
106	Wax in ear
**320	Sprain - Strain Vertebral
Non-Migrants	
**119	Elevated BP w/o Hypertension
019	Warts, All Sites
**050	Diabetes Mellitus
**340	Prophylactic Immunization
**143	Emphysema, COPD, COLD ***
055	Obesity

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone: 616-887-8831.
International Classification of Health Problems in Primary Care, Second Edition.
Migrant N = 528
Non-migrant N = 2,849
**Not found in female population
***COPD = Chronic obstructive pulmonary disease
COLD = Chronic obstructive lung disease

How Much of a Problem Are Chronic Conditions Among Farmworkers?

The extent of unmet health care needs can be measured by community or labor camp surveys of farmworkers. For example, a national survey (Cortés, 1974) of the vocational rehabilitation needs of the migrant farmworker population found that in 44.5% of the nation's migrant and seasonal farmworker households, one or more family members were disabled. Among middle-aged and older workers, a disproportionate number suffered from a combination of problems such as arthritis, vaguely defined back and leg pains, and high blood pressure. Other disabled workers, regardless of age, were limited by the effects of untreated congenital ailments and other chronic health problems.

It is critical that these kinds of survey data supplement the often incomplete information obtained from the migrant health centers because farmworkers often do not seek preventive services or medical care for many chronic conditions, and, even more importantly, because only 17% of all migrant and seasonal farmworkers (460,000 of 2.7 million) are treated by federally funded migrant health facilities (Reig, 1985).

TABLE 17
COMPARISON OF MIGRANT AND NON-MIGRANT CLINIC PATIENTS IN 20 MOST FREQUENTLY OBSERVED CONDITIONS (APPROX. 75% OF ALL CONDITIONS)*

BOTH SEXES — ALL AGES

Migrants	
002	Infectious Intestinal Diseases, Unspecified
103	Eustachian Block
092	Conjunctivitis
135	Acute Tonsillitis, Quinsy
207	Boils, Cellulitis, Abscess
210	Impetigo
106	Wax in ear
Non-Migrants	
327	Bruises, Contusions, Crushing
055	Obesity
323	Lacerations, Open Wound
185	Vaginitis NOS**
229	Osteoarthritis
019	Warts, All sites
072	Depressive Neurosis

*Unpublished 1979 data from Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345, phone 616-887-8831.
International Classification of Health Problems in Primary Care, Second Edition.
Migrant N = 1,521
Non-migrant N = 8,496
**NOS = Not otherwise specified

The National Center for Health Statistics recently began publishing the results of the Hispanic Health and Nutrition Examination Survey (Hispanic HANES) conducted between July 1982 and late 1984 in Arizona, California, Colorado, New Mexico, Texas, and the New York City and Miami areas. This first large-scale survey of Hispanics living in the United States will provide data on illness, disability, need for treatment or care, nutritional status, patterns of growth and development, and measures of health and well-being.

The Hispanic HANES included a medical and dental examination of interviewees and extensive laboratory testing (e.g., assays for vitamin A, cholesterol, iron, syphilis) as well as mental health and substance abuse questionnaires. The laboratory tests included urine and blood checks for the presence of lead, carbon monoxide, and pesticide body burdens (U.S. Department of Health and Human Services, 1983). Occupational questions, including pesticide exposure and availability of field sanitation facilities, also were a part of the survey.

Although approximately 12,000 Hispanics between the ages of six months and 74 years were included, it is estimated that less than 200 Hispanic *migrant farmworkers* were surveyed (Murphy, 1985).

Wisconsin

In 1981, Slesinger and Cautley reported the results of a 1978 survey of 262 migrant farmworkers in Wisconsin to determine their patterns of medical utilization. Respondents were read a list of 24 common medical conditions and asked if each condition bothered them "very much," "some," or "not at all." Ultimately the first two categories were combined since only about 2% of the migrants mentioned any condition that bothered them "very much." The ten most frequently mentioned conditions are listed in Table 18.

It should be noted that all the conditions listed in Table 18, except for "tooth or gum trouble" and "backache," are possible signs of pesticide exposure, a point that is not discussed in the article.

One aspect of the issue that the authors did examine was the impact of an individual's sex and age on medical care utilization and the reasons why the respondents had obtained care during the previous year. (That information is presented in Table 19.) As in most health surveys, women reported more health problems than men, especially in the area of mental distress.

In contrast to other studies, the reason for the largest proportion of migrant farmworker physician or clinic visits was a general physical examination (20.9%); prenatal visits were not examined in this study. The second most frequently stated reasons for a medical visit were orthopedic or musculoskeletal problems (12.5%). Minor illnesses or infections such as colds were third (8.8%), followed by skin problems (8.3%), gastrointestinal/digestive problems (7.9%), and genitourinary/reproductive conditions (6.9%).

The authors compared these reasons for medical visits with the reasons given most often in the National Ambulatory Medical Care Survey of office visits taken in 1975, in which check-ups and preventive medical procedures constituted the most common reasons for an office visit. The second and third most prevalent reasons for office visits, however, were diseases of the respiratory and circulatory systems, respectively. Slesinger and Cautley concluded that the migrant farmworkers' high frequency of clinic visits for orthopedic, muscular, and skin conditions could undoubtedly be attributed to work-related causes.

TABLE 18
MOST FREQUENTLY MENTIONED
MEDICAL CONDITIONS AMONG MIGRANT FARMWORKERS
WISCONSIN, 1978*

Medical Condition	*% Total Respondents (N = 378)*	*% Males (N = 228)*	*% Females (N = 150)*
Headaches	32.5	22.7	47.3
Eye trouble	31.7	23.5	44.1
Backache	26.7	23.9	30.9
Tooth or gum trouble	25.9	21.2	32.9
Nervousness	19.6	11.9	31.4
Irritability	17.6	13.7	23.5
Trouble sleeping	16.1	10.0	25.3
Coughing	14.0	11.6	17.6
Stomach pains	13.6	7.2	23.4
Low spirits	10.5	3.9	20.7

*Slesinger and Cautley (1981), p. 258.

TABLE 19
PERCENTAGES OF MIGRANT FARMWORKERS WHO HAD VISITED A PHYSICIAN OR CLINIC DURING THE PRECEDING YEAR FOR VARIOUS REASONS, BY AGE AND SEX*

		Age		*Sex*	
Reason for Visit	*Total Workers (N = 216)*	*Less than 30 (N = 75)*	*30 and over (N = 141)*	*Male (N = 124)*	*Female (N = 92)*
Percentage who visited physician or clinic	57.0	47.5	63.6	53.4	62.4
Probability		<0.025		Not significant	
Checkup, general examination	20.9	24.1	19.1	18.4	23.5
Orthopedic or musculoskeletal	12.5	1.3	18.4	16.8	5.3
Minor illness or infection	8.8	16.0	5.0	8.8	9.6
Skin problem	8.3	8.0	8.5	12.8	2.1
Gastrointestinal/Digestive	7.9	1.3	11.3	8.0	7.4
Genitourinary/Reproductive	6.9	10.7	5.0	1.6	13.8
Mental/Emotional Problem	4.6	5.3	4.3	2.4	7.4
Eye Problem	4.2	4.0	4.3	6.4	2.1
Diabetes	3.7	1.3	5.0	0.8	7.4
Cardiovascular Problem	3.2	0.0	5.0	4.0	2.1
Respiratory Problem	2.8	1.3	3.5	4.0	1.1
Injury	2.8	8.0	0.0	2.4	4.3
Surgery	2.3	6.7	0.0	3.2	1.1
Other	9.7	8.0	10.6	10.4	9.6
No Answer	1.4	4.0	0.0	0.0	3.2

Note: All percentages are based on weighted numbers of respondents.
*Slesinger and Cautley (1981), p. 259.

In Table 19, we also can see the differences between the "under 30" and the "30 and over" categories. The younger workers sought medical attention more often for minor illnesses, while the older workers were more likely to seek care for orthopedic, gastrointestinal, and digestive problems. When sex differences were examined, it was found that men sought care more often for orthopedic and skin problems, and women reported more visits for treatment of genitourinary and reproductive system conditions.

Texas

A 1979 report by the Lyndon B. Johnson School of Public Affairs, at the University of Texas at Austin, examined the health status of Mexican-Americans in south Texas. Although the mortality and morbidity statistics were not broken down by occupation, these data are worth considering in discussions of farmworkers' health. About 25% of Mexican-Americans in south Texas work as migratory farm laborers (approximately 250,000 of the 1,100,000 Mexican-Americans as of 1970). Almost 60% of the population of south Texas are Hispanic, according to 1970 census data (LBJ School of Public Affairs, 1979).

In Table 20, death rates for 1969 to 1971 resulting from the ten most common causes of death in Anglos and Mexican-Americans are compared by cause. Because the two populations' age compositions differ significantly (30.2 median years for Anglos versus 19.0 years for Mexican-Americans), adjustments for age were made to allow comparison of similar populations.

TABLE 20
CAUSE-SPECIFIC DEATH RATES* FOR MEXICAN-AMERICANS STANDARDIZED TO THOSE FOR ANGLOS, TEXAS, 1969-71**

	Anglos Crude Death Rate		*Mexican-Americans Standardized Death Rate*	
Cause of Death	*Males*	*Females*	*Males*	*Females*
All Causes	991.86	728.36	995.01	862.80
Infective & Parasitic Diseases	8.59	6.28	26.87	18.70
Neoplasms, Total	174.41	132.97	143.72	147.73
Trachea, Bronchus, Lungs	58.44	13.00	33.83	14.12
Other Digestive Sites	17.17	13.24	24.52	26.02
Large Intestine, Rectum	17.12	18.62	10.39	9.58
Lymphatic and Hematopoietic	18.97	14.48	13.71	10.27
Prostate	15.86	—	11.38	—
Breast	—	24.47	—	19.53
Ovary	—	9.40	—	9.18
Cervix Uteri	—	5.38	—	12.59
Diabetes Mellitus	11.84	16.24	27.96	52.95
All Circulatory Diseases	501.80	395.77	472.70	407.62
Hypertension	7.58	9.08	8.37	13.31
Ischemic Heart Disease	332.19	217.23	256.78	224.99
Diseases of the Arteries	27.25	26.73	24.41	27.51
Cerebrovascular Disease	88.69	107.68	88.97	99.87
Other Heart Diseases	34.98	24.42	38.42	31.00
Other Circulatory Diseases	11.11	10.69	9.75	10.94
Influenza and Pneumonia	29.90	25.63	36.87	36.85
Other Respiratory Diseases	39.67	13.12	22.75	14.08
Digestive Diseases, Total	35.89	27.51	53.03	41.52
Congenital Anomalies	8.74	7.47	10.76	8.02
Perinatal Mortality	22.25	14.07	27.81	18.21
Accidents	108.59	47.64	143.26	37.63

Source: Fonner, Edwin Jr., *Mortality Differences of 1970 Texas Residents: A Descriptive Study*, Master's Thesis, School of Public Health, University of Texas Health Science Center at Houston, September 1975.

*Rates are per 100,000 population.

**Lyndon B. Johnson School of Public Affairs (1979), p. 20.

While Anglo men compared to Mexican-American men have higher or similar rates for most of the degenerative diseases, Mexican-American women have higher rates than Anglo women for all degenerative conditions except cerebrovascular disease.

Even after adjusting for age differences, Mexican-Americans have higher death rates for those conditions not (or not necessarily) associated with old age such as infectious and parasitic diseases, diabetes mellitus, influenza and pneumonia, perinatal mortality, congenital anomalies, and digestive diseases, including cancer in other digestive sites.

The authors also cited 1975 Texas death certificate data that showed similar differences between Anglos and Mexican-Americans. Accidents accounted for 11.9% of deaths among Mexican-American males compared to 7.7% of deaths among Anglo males. Another notable statistic was that 21% of all deaths among Mexican-American men between the ages of 15 and 29 were caused by homicide compared to 9% among Anglo men of the same age group. Within the 45-64 age group, deaths from cerebrovascular disease, diabetes mellitus, and cirrhosis of the liver occurred more often among Mexican-Americans than among Anglos.

With regard to morbidity data, comparison of reportable communicable disease rates between south Texas and the rest of the state showed that communicable disease rates were higher in the southern part of the state for all diseases except typhoid fever (see Table 21). The four most prevalent diseases were hepatitis, tuberculosis, meningitis, and amebiasis, all of which are easily spread in overcrowded, unsanitary environments. Review of the south Texas data by county showed that rates of tuberculosis and amebiasis in counties along the Mexican border were 150-200% higher than the overall Texas rates.

TABLE 21
REPORTABLE COMMUNICABLE DISEASE RATES PER 100,000 POPULATION
TEXAS AND SOUTH TEXAS, 1974-76*

	South Texas		*Balance of Texas*	
Disease	*Number*	*Average Annual Rate*	*Number*	*Average Annual Rate*
Hepatitis, all forms	2,552	41.60	8,844	29.90
Tuberculosis	1,902	31.00	5,463	18.46
Meningitis, aseptic	204	3.33	698	2.36
Amebiasis	117	1.91	344	1.16
Typhus, endemic	85	1.39	12	0.04
Encephalitis, infectious	70	1.14	77	0.26
Brucellosis	23	0.38	71	0.24
Leprosy	22	0.36	29	0.10
Typhoid Fever	8	0.13	42	0.14
Diptheria	4	0.07	12	0.04

Source: Texas Department of Health Resources, *Texas Morbidity This Week, 1974, 1975, and 1976 Annual Summaries.*
*Lyndon B. Johnson School of Public Affairs (1979), p. 25.

Western States

California

Mines and Kearney (1982) studied the work and health histories of the farmworker population in central California's Tulare County. One part of their research involved an ethnographic analysis to document the cultural practices and social structure of the population. The other part consisted of survey research of 472 families or single individuals, a total of 1,893 persons. The farmworker population was divided into five categories:

- Type 1—newcomer immigrant Mexican families who had been in Tulare County seven years or less;
- Type 2—settled immigrant Mexican families who had been in Tulare County eight years or more;
- Type 3 — lone male migrants who return to their families in Mexico;
- Type 4 — lone male non-Mexican migrants and immigrants; and
- Type 5 — citizen farmworker families (mostly from Texas).

Over 90% of the study population's heads of household were Mexicans from Texas or Mexico; the remainder were Filipino, Central American, Middle Eastern, black, French, and Anglo.

The research findings on the health of the study sample included the following information:

(1) The most common serious health problems that required medical attention for adults were accidents and injuries. Musculoskeletal problems received the most medical treatment among the elderly, while children were most often treated for infectious diseases (see Table 22).

(2) The most common minor health problems in the sample, in order of decreasing prevalence, were: "mental" complaints such as headaches and nervousness, dental problems, skin irritations, respiratory problems, and musculoskeletal problems (see Table 23).

(3) The most common work-related health problem was injury (56%); an additional 21% of the sample had musculoskeletal problems, and 6% had skin problems (see Table 24). These problems resulted in an average of *21 days* of lost work per episode.

(4) Although injuries were the main cause of job-related health problems, farmworker respondents feared chemicals even more than accidents. In general, however, they rarely missed work or sought medical treatment for chemical-related problems. Over 45% of the workers stated that they got rashes, 44% said they had had headaches, and 26% mentioned that they had suffered eye irritations from agricultural chemicals. Chemicals used on grapes seemed to cause more trouble than any other combination of crop and chemical.

(5) Dental problems were widespread. Seven percent (7%) of the sample population had bleeding gums, and 28% over five years of age had lost at least one permanent tooth. Over 42% had never seen a dentist, and over 60% had never seen an eye doctor.

(6) Of the 229 women who answered questions about their reproductive histories, 24.4% said they had had at least one miscarriage, 10% said they had had one or more, while 6.9% reported having had at least one stillbirth.

(7) Vaccinations and regular examinations of small children were quite common; in fact, some farmworker children may have been over-vaccinated due to frequent school changes. Over half of the women said they participated in the Women, Infants and Chil-

TABLE 22
SERIOUS HEALTH PROBLEMS BY AGE*

Age	*N*	*Most Common*	*%*	*Second Most Common*	*%*
0-14	85	Infections	22.4	Accidents	21.2
15-29	131	Accidents	33.6	Mental	9.9
30-44	88	Accidents	27.3	Mental	13.6
45-59	49	Accidents	36.7	Mental	12.2
60 & over	19	Orthopedic/muscular	26.3	Respiratory	21.1

*Mines and Kearney (1982), p. 52.

dren (WIC) nutrition program, although only a small percentage participated in migrant education programs.

(8) Overall, farmworkers paid for most of their health care themselves. Even chemically induced problems were usually paid for by the worker himself or herself.

(9) The private doctor was the most common medical provider for people in the sample. Clinics were the next most frequent source of medical care. Types 2 and 5, who had higher incomes, used doctors more frequently than others. Type 1 individuals used public clinics more often than the other types of families.

These researchers made several recommendations about means of improving workplace conditions and overcoming barriers to seeking health care. These included: the development of health services directories in English and Spanish to provide pointers on how best to use the various facilities; employer-provided education for farmworkers on insurance coverage, workers' compensation, and Social Security, including information on filing claims; the development of personal health records farmworkers could keep and present to health care providers wherever they seek help; farmworker training regarding agricultural chemicals; the provision of protective clothing and sanitation facilities at the worksite; and the enforcement of existing occupational safety and health laws. The enforcement of existing housing laws and regulations also would be a useful addition to their list.

TABLE 23
COMBINED MINOR AND SERIOUS CONDITIONS*
N = 1,893

Condition	*Frequency*	*Percent*
Mental	557	29.4
Dental	371	19.6
Allergies/skin	317	16.7
Respiratory	305	16.1
Musculoskeletal	263	13.9
Gastrointestinal	227	12.0
Handicap	226	11.9
Urologic	136	7.2
Cardiovascular	115	6.1
Anemia	115	6.1
Diabetes	25	1.3
Venereal disease	15	0.8
Cancer	9	0.5

*Mines and Kearney (1982), p. 50.

TABLE 24
WORK-RELATED HEALTH PROBLEMS*
N = 285

Problem	*Frequency*	*Percent*
Injury	159	55.8
Orthopedic/musculoskeletal	60	21.1
Skin	17	6.0
Minor illness, infection	14	4.9
Chemical poisoning	8	2.8
Respiratory	7	2.5
Eye	6	2.1
Other	14	5.0

*Mines and Kearney (1982), p. 53.

Colorado

Sunrise Community Health Center, Inc. in Greeley, Colorado, conducted a survey in 1982 of migrant farmworkers and poor local residents to compare their health (Ackerman and Simkovic, 1983). About half of each of these groups were chosen from among patients seen at Sunrise during the previous 24 months. The other half were "non-users" referred either by the migrant patients or, in the case of the non-migrant non-users, randomly chosen residents of local low-income neighborhoods that had large Hispanic populations.

The migrant farmworker sample included 303 persons, 202 adults and 101 children, and the non-migrants numbered 130, including 66 adults and 64 children. They used a modified questionnaire based on the Health and Nutrition Examination Survey (HANES) of the National Center for Health Statistics. In addition, trained teams of nurses performed specific health status evaluations such as blood pressure, blood glucose and hematocrit levels, and dental check-ups.

This study produced the following results:

(1) Migrants lived in lower quality housing than that of the local population. Migrants were significantly more likely to be without running water, hot water, or adequate screens. They were also much less likely to have their own phone or have access to one within one-fourth of a mile of their residence.

(2) Medical services were poorly utilized by both the migrant farmworkers and the local residents. Although there were no major differences in their perception of access to medical care, twice as many local adults (80%) as migrant adults (41%) had used health care services at Sunrise within the previous two years. Migrants who had not used local health care also were hospitalized less often than the local group. (The authors hypothesized that this was due to very limited access to care, not because of less need for hospitalization.)

(3) Migrant farmworkers were much more likely to never have had their hearing tested (56% versus 31% of the local population). Those migrants who had had it tested had done so only recently.

(4) Migrant farmworkers were much more likely than local residents to have elevated blood sugar that had gone undetected.

(5) The migrant farmworker population had experienced more gross tooth decay and probably had more need to have teeth pulled than did the local population. Forty-two percent (42%) of migrant adults had never seen a dentist, as compared to 11% of the local population.

(6) Seventeen percent (17%) of both the local and the migrant adult population suffered from uncontrolled high blood pressure (i.e., systolic pressure over 140, a diastolic pressure greater than 90, or both).

(7) Twelve percent (12%) of both the migrant and the local women were classified as anemic (hematocrit of 35 or less). A greater percentage of migrant farmworker women as compared to local women did not know they were anemic.

(8) Less than half (48%) of the migrant women in their child-bearing years were using some form of birth control compared to 83% of the local women. Both groups had an average of more than six pregnancies per woman. The fetal wastage rate (total number of miscarriages and stillbirths divided by the total number of pregnancies) was high in both groups, averaging 20-22% of the population.

(9) One-third of the eligible migrant women and one-fourth of the eligible local women were not enrolled in the federal Women, Infants and Children (WIC) supplemental food program.

(10) Nearly twice as many migrant babies were considered premature by birth weight (less than 2500 grams or 5.5 lbs.) as reported by their mothers (8.6% versus 3.5% of the local babies). Approximately 20% of the migrant farmworker mothers were considered at high risk of developing gestational diabetes. Thirteen percent (13%) of the migrant mothers gave birth when they were over 35 years of age compared to only 3.5% of the local sample. Except for the fact that the women in the local sample had a larger proportion of teenage mothers (18% versus 12% among migrants), the other factors (low birth weight, high birth weight, and maternal age) indicated that the migrant mothers were more at risk of developing pregnancy complications than were the local mothers.

(11) Adult migrant men, particularly older adults, were generally unreceptive to offers of free medical screening and displayed what seemed to be culturally based negative attitudes about the appropriateness of their receiving modern medical care.

(12) Only the migrant farmworkers gave affirmative answers to the HANES questions related to chronic gastrointestinal complaints such as difficulty in swallowing, nausea, vomiting, and chronic abdominal pain. While the rates of affirmative answers were too low to be significant for the sample size, the responses may provide a good indication of chronic low level pesticide exposure. The calculated rates per 1,000 persons by complaint were: difficulty swallowing, 10/1,000 (or 1%); nausea alone, 30/1,000 (3%); vomiting, 15/1,000 (1.5%); and chronic abdominal pain, 45/1,000 (4.5%).

Ackerman and Simkovic concluded that, in all but a few cases, the health of adult migrant farmworkers was as bad or worse than that of the poor local residents. In the situations where the level of health was the same as the local population, the migrants saw themselves as healthier than the local group, presumably because the migrant farmworker group was less educated than the local group about what constitutes good health.

Idaho

In 1976, Community Health Clinics, Inc., a nonprofit health corporation with clinics in three towns in southwest Idaho, undertook a project funded by the National Institute for Occupational Safety and Health (NIOSH). The purpose of the project was to develop, test, and evaluate a model program aimed at identifying health and safety problems in agricultural work (Bondy et al., 1976). As part of the project, baseline health information was collected on 640 area farmers, ranchers, farmworkers, and their families. (It was not specified whether the farmworkers were migrants, seasonals, or both.) They were asked about their medical and occupational histories and given physical examinations that included laboratory tests and diagnostic screening such as red blood cell and plasma cholinesterase levels, blood sugar levels, tuberculin skin tests, electrocardiograms, and audiograms.

Clinic outreach workers also conducted standardized interviews with 99 farmers and 72 farmworkers, who were asked questions about past or present problems with eye, ear, lung, skin, and musculoskeletal disorders, their use of safety equipment, safety training, work experience, and environmental exposures. Farmer and farmworker data from the interviews are compared in Table 25.

TABLE 25
COMPARISON OF FARMER AND FARMWORKER DATA*

	Farmer (N = 99)	*Farmworker (N = 72)*
Average estimated age	44 years	34 years
Sex ratio (male/female)	73/26	33/39
Race ratio (Mexican-American/Anglo)	1/98	67/5
Smokers (more than half pack per day)**	27%	19%
Lost time from work**	35%	17%
Near accidents**	29%	8%
Interested in farm safety program**	53%	72%
Anything with work unsafe**	14%	17%
Dizziness and nausea**	18%	41%
Eye problems**	37%	35%
Hearing problems**	30%	25%
Chronic cough**	12%	15%
Shortness of breath**	13%	29%
Skin rash**	15%	24%
Aches and pains**	30%	25%

*Bondy et al. (1976), p. 51.
**Percent yes.

The average farmer was a 44-year-old Anglo male working with most, if not all, of the farm machinery. In contrast, the average farmworker was a 34-year-old Mexican-American female working in a large sugar beet field.

There was a statistical difference ($p < 0.05$) between the two groups with regards to sex, race, lost work time, near accidents, interest in safety programs, and dizziness and nausea. Almost three-quarters of the farmworkers expressed interest in receiving farm safety training compared to half the farmers. Farmers reported more than twice as many "near accidents" and lost work time due to farm-related accidents or illnesses. This difference might be due to the kinds of work done by farm owners such as the operation of farm machinery or application of fertilizers and pesticides and/or the reluctance of farmworkers to miss work and lose wages when they are hurt or ill.

Farmworkers reported more problems with dizziness and nausea, shortness of breath and coughing, and skin rashes, while farmers cited more problems with hearing and aches and pains. Although more farmers smoked, chronic cough and shortness of breath were reported more often by farmworkers. The authors hypothesized that this was due to the sex difference but suggested that it could be due to an unmeasured factor such as obesity. Another possible explanation is the farmworkers' chronic exposure to high levels of respirable dust and to allergenic pollens, plants, and chemicals (see chapter XV).

In Table 26, the health problems found during physical examination of all study subjects are summarized. An attempt was made to determine which complaints were work-related, although this was often impossible to determine either because the physician did not ask the patient or because this information was not entered on the patient's medical record. In addition, the validity of subjective patient complaints had to be judged by the clinician.

It should be noted that no attempt was made to relate some of the health problems (e.g., birth defects, insomnia, and neuropsychiatric problems) to any kind of agricultural exposure. Although pesticides can cause any of these problems, strict cause and effect are often difficult to prove.

The authors concluded that no unexpected or startling cause-and-effect relationships between farmwork and ill health were shown; however, the relationships between obesity, hypertension, diabetes, joint pain, headache, high blood pressure, elevated glucose and triglyceride levels, smoking, sex, and age were illustrated. They noted that exposure to agricultural chemicals may increase blood pressure readings, that the stress involved with the instability of migrant farmwork may lead to alcohol abuse and/or hypertension, and that poverty level incomes may be a contributing factor to obesity; nonetheless, the authors concluded that only trauma from farm accidents was shown to be a definite work-related hazard.

There were distinct methodological limitations in this study: no controls were used, thereby making it difficult to make solid conclusions based on statistical results; data gathered and recorded by physicians in patient medical records were not standardized; the implementation of a medical checklist was begun too late in the study to be of much use; and equipment and laboratory services also were not standardized.

TABLE 26
SUMMARY OF ANALYSIS OF PROBLEMS FOUND DURING EXAMINATIONS*

Problem	*No. Respondents*		*Percent of Total*			*Agriculturally*
	No	*Yes*	*"Yes"*	*Past*	*Present*	*Related*
Conjunctivitis	625	9	1.5	5	4	1
Pterigium	625	9	1.5	1	8	1
Otitis media	581	56	8.8	35	21	—
Otitis externa	631	6	1.0	5	1	—
Sinusitis	631	6	0.9	4	2	—
Headache	578	57	8.9	37	20	—
Chronic cough	610	27	4.3	7	20	1
Shortness of breath	613	24	3.8	8	16	3
Rash	593	43	6.7	20	23	6
Joint-motor limit	623	13	2.0	8	5	2
Muscle strain	618	18	2.8	14	4	—
Severe trauma	602	34	5.3	33	1	4
Chronic UTI	628	8	1.2	2	6	—
Birth defect	634	2	0.3	2	—	—
Joint pain	595	41	6.4	24	17	1
Dizziness	42	22	3.4	13	9	1
Insomnia	15	12	1.9	3	9	—
Neuropsychiatric	592	23	3.6	6	17	—
Diabetes	614	26	4.0	2	24	—
Hypertension	599	41	6.5	1	40	—
Obesity	516	124	19.4	2	122	—
Smoking	476	95	14.9	—	95	—

*Bondy et al. (1976), p. 60.
N = 640

As in any occupational study, we must consider the phenomenon of the "healthy worker effect," the premise of which is that workers who are unable to perform a job will drop out of that kind of work so that only the healthiest workers remain. It is not known how many farmworkers stop doing agricultural work after they have an occupational accident or injury. For example, a pesticide poisoning victim may subsequently develop a generalized sensitivity to agricultural chemicals, making it difficult to continue farmwork. When an acute or chronic problem becomes too severe, that worker will disappear from both the agricultural workforce and health/agricultural studies.

Utah

Anderson and Kane (1977) reported on the patterns of care given to migrant farmworkers in Utah by private physicians and migrant health centers during the 1973 season. They included information on the 17 most common acute and chronic health problems among migrant patients, which are listed in Table 27 and accounted for 51% of all diagnoses in that year.

"Streptococcal" pharyngitis constituted about 7% of the problems, although this diagnosis was a clinical one and did not necessarily indicate presence of a positive throat culture. Pharyngitis and upper respiratory infections together accounted for almost 14% of all diagnoses. The next most frequent problem was minor trauma (5%); dermatitis and bacterial skin infection together accounted for 6% of the problems noted. Diarrhea and influenza syndrome combined accounted for 5% of illnesses; in fact, some form of gastrointestinal upset was the third most common health problem among these migrants. All infectious diseases together made up at least a third of the diagnoses.

Olsen et al. (1976a) attempted to document the prevalence of chronic disease among migrant and seasonal farmworkers in Utah and North Dakota by screening 10% of this population during the 1975 harvest season (see Table 28). The Utah study population was 15% Native American, and the rest were Hispanic; the North Dakota migrants all were Hispanic. Where possible, these authors compared their prevalence data with the figures for non-migrant populations.

Their findings included the following:

(1) Elevated blood pressure was not more prevalent in this migrant farmworker population than in the National Health Survey.

(2) A higher percentage of migrants (9%) had abnormal electrocardiograms than did those in a study conducted by Averill (1960) on military men of compa-

TABLE 27
MOST COMMON ACUTE AND CHRONIC HEALTH PROBLEMS IDENTIFIED AMONG MIGRANT PATIENTS IN UTAH*

Problem	*Identified by —*			
	Private Physicians		*Clinics*	
	Number	*%***	*Number*	*%***
Pharyngitis or tonsillitis	48	14	76	6
Viral upper respiratory infection	12	4	102	7
Minor trauma	14	4	83	6
Dermatitis	6	2	69	5
Otitis media	12	4	35	3
Bacterial skin infection	8	2	42	3
Diarrhea	9	3	37	3
Influenza syndrome	8	2	28	2
Musculoskeletal aches and pains	8	2	45	3
Bronchitis	14	4	16	1
Abdominal pain, etiology unknown	8	2	26	2
Essential hypertension	6	2	32	2
Iron deficiency anemia	5	2	25	2
Urinary tract infection	6	2	15	1
Low back pain	5	2	22	2
Vaginitis or cervicitis	7	2	18	1
Hay fever or other allergy	4	1	24	2
Total	180	54	695	50
Total, all acute and chronic problems	333	100	1,377	100

*Anderson and Kane (1977), p. 329.

**Of all acute and chronic problems identified.

rable ages engaged in military activities (4%).

(3) Pulmonary disease appears to be more prevalent among migrant farmworkers than in other populations.

(4) The Utah migrants seemed to have abnormal visual acuity rates (26%) that were greater than the national average (21%).

(5) There seemed to be more chronic or acute tympanic (eardrum) changes in the Utah migrants (28%) than in the North Dakota migrants (7%) or in the national survey respondents (23%).

(6) Mid-range hearing loss (greater than 25 db for 1,000 or 2,000 Hz) at both sites was slightly higher than the national average (8% in the Utah migrants and 7% among the North Dakota migrants versus 3% in the non-migrant population).

(7) Urinary tract infections did not seem to occur more frequently among migrant farmworkers than among other populations, with the possible exception of the slightly elevated rate of positive urine cultures (11% in Utah and 7% in North Dakota versus 3% of the non-migrant group).

(8) A higher percentage of migrant farmworkers had hematocrit that was low for their sex compared to a Salt Lake City urban population (12% for Utah migrants and 21% for North Dakota migrants versus 9% for the urban group).

(9) Over one-fourth of the Utah migrant farmworker women (29%) had abnormal Pap smears compared to 7% of the women in the Salt Lake City study.

(10) Twenty-one percent (21%) of the Utah migrants had positive skin tests for tuberculosis compared to 14% nationwide and 4% reported by the Utah State Division of Health for a non-migrant population. The fact that there were no positive tests among the North Dakota migrants is probably due to an inadequate method of follow-up. A portion of the high number of positive TB tests may be attributable to the BCG immunization program in Mexico, after which a vaccinated patient always screens positive on skin tests (Olsen, 1982).

(11) Dental health was poor among migrant farmworkers: a large percentage of the migrants at both sites had more decayed teeth (not filled or missing) than average for their age (41% for Utah, 19% for North Dakota).

(12) Malnutrition did not seem to be a problem; however, 10% of the migrant group appeared to be obese.

(13) Abnormal range of motion in the joints was observed; this may be due to the stress agricultural work puts on joints and muscles.

TABLE 28
CHRONIC HEALTH PROBLEMS OF UTAH AND NORTH DAKOTA MIGRANT ADULTS*

Test	*Percent Utah(a)*	*Percent North Dakota(b)*	*Reference Population*
Weight greater than norm for sex, age, height (X ± 2 SD)	11	10	—
Hematocrit Low	12	21	9(c)
Abnormal EKG	8	10	4(d)
Heart Murmurs	17	7	NA(e)
Abnormal Respiratory Functions	13	47	—
Gum Disease Present	29	10	NA(e)
Vision Less than 20:40	26	13	21(f)
Change or Damage to Eardrum	28	7	23(f)
Mid-Range Hearing Loss	8	7	3(f)
Urinary Tract Infections	11	7	3(g)
Positive VDRL (Syphilis)	4	0	0.05(f)
Positive Pap Smear	29	5	7(c)
Positive TB Test	21	0	4-14(h)
Abnormal Joint Function	10	1	NA(e)
Blood in Stool	11	3	7(i)

— = Already being compared with normal.
(a) Sample sizes vary from 70 to 314 (random)
(b) Sample sizes vary from 41 to 110 (nonrandom)
(c) Olsen et al. (1976b)
(d) Averill (1960)
(e) Comparable data not available
(f) National Health Survey (1965)
(g) Collen et al. (1970) (Kaiser Permanente data)
(h) Utah State Division of Health
(i) Greegor (1967)

*Adapted from Olsen et al. (1976a) and Olsen (1982).

(14) The adults in Utah were also tested for red blood cell cholinesterase levels, which are depressed by pesticide exposure. The average blood cholinesterase level of the migrant farmworkers was significantly lower than that of an age- and sex-matched control group.

In addition to their 1976 study, the Utah Rural Development Project also undertook a health screening project of 188 adult male migrant and seasonal farmworkers during the 1983 harvest (Viavant et al., 1983). The project was designed to address the issue of underutilization of health services by the adult male client population. Its objectives were to promote awareness and correct use of the available health services, better determine the health status and needs of that population, and develop a project plan to address some of those needs.

Visual acuity screening, blood pressure, hematocrit, blood glucose, abnormal urine findings, TB skin tests, and syphilis serology (RPR) were some of the tests that were used. A brief medical and family history also was taken.

Eighty percent (80%) of the farmworkers were migrants, the rest seasonal workers. About three-fourths (73%) were Hispanic, 21% Native American (Navajo and Kickapoo), and 11% were white. The majority of the men were between 20 and 39 years of age (65%), and the age range of the group was 17 to 60+. Screening revealed the following information:

(1) Twelve percent (22/186) of clients screened had distance vision worse than 20/40 in both eyes, or severely worse in one eye.
(2) Twenty-two percent (25/113) had vision that was worse than 20/40 for close range.
(3) Blood pressure readings with a diastolic pressure greater than 85 mmHg were found in 19% (36/188) of those screened and 90 mmHg or greater in 13% (25/188). It was not possible to obtain second readings in many cases, and the stress of the clinical setting must be taken into account; however, the authors concluded that these findings still may have indicated borderline hypertension.
(4) Three previously diagnosed diabetics were among those screened. Another nine clients (6%) had abnormally high blood glucose (>120 mg/dl two or more hours after eating) that had not been detected previously.
(5) Reading the TB skin test 48-72 hours after administration was a problem. Almost one-third (31%) of tests were not read, despite concerted efforts to track down clients. Of those read, 30% were positive. This high percentage is partially due to the administration of BCG vaccine in Mexico.
(6) Six clients (3%) showed weakly positive RPR serology (syphilis).
(7) Six clients were referred to the clinic mental health specialist for counseling.
(8) Nearly half of all clients complained of eye problems: itching, burning, fatigue, watering, or blurred vision. This far exceeded the number with problems of acuity and may indicate occupational exposure to pesticides, dusts, or other irritants.

REFERENCES CITED

Ackerman, A. and Simkovic, J.: *Final Report - Special Migrant Initiative: 1982 Survey to Compare the Health Status of Migrants with Local Residents*. Published by Sunrise Community Health Center, 1028 5th Avenue, P.O. Box 1870, Greeley, CO 80632, 1983.

Anderson, W.W. and Kane, R.L.: Patterns of Care Given Migrant Workers in Utah by Private Physicians and Clinics. *Public Health Reports* 92(4):326-331, 1977.

Averill, K.H. and Lamb, L.E.: Electrocardiographic findings in 67,375 asymptomatic subjects: I. Incidence of Abnormalities. *American Journal of Cardiology* 6:76-83, 1960.

Bleiweis, P.R., Reynolds, R.C., Cohen, L.D., and Butler, N.A.: Health Care Characteristics of Migrant Agricultural Workers in Three North Florida Counties. *Journal of Community Health* 3(1):32-43, 1977.

Bondy, M.K., Lebow, R.H., O'Malley, M., et al.: *Occupational Health and Safety for Agricultural Workers*. Washington, D.C.: U.S. Government Printing Office, DHEW (NIOSH) Publication No. 77-150, December 1976.

Chase, H.P., Kumar, V., Dodds, J.M., et al.: Nutritional Status of Preschool Mexican-American Migrant Farm Children. *American Journal of the Diseases of Childhood* 122:316-324, 1971.

Collen, M.F., Feldman, R., Siegelaub A.B., et al.: Dollar Cost per Positive Test for Automated Multiphasic Screening. *New England Journal of Medicine* 283(9):459-463, 1970.

Cortés, M.D.: *Handicapped Migrant Farm Workers: Characteristics of Disabled Migratory and Seasonal Agricultural Workers and Their Families, Impact of the State/Federal Vocational Rehabilitation Program, and Strategies for Expanding Services*. Washington, D.C.: U.S. Department of Health, Education and Welfare, DHEW Publication No. (OHD) 75-25084, December 31, 1974.

Ehrlich, S.P. and Hardgrave, S.W.: Pesticide poisoning and other occupational hazards among North Carolina farmworkers. Unpublished paper, 1981. Available from Bea Bobotek, Librarian, Migrant Legal Action Program, Inc., 2001 "S" Street, N.W. #310, Washington, D.C. 20009.

Greegor, D.H.: Detection of Silent Colon Carcinoma in Routine Exams. *Cancer* 19(6):330-337, 1969.

Hicks, W.: Personal communication with Mr. William Hicks, Director of Research, National Association of Community Health Centers, Inc., 1625 "I" Street, N.W., Suite 420, Washington, D.C. 20006 (phone: 202-833-9280), June 18, 1985.

Hicks, W.: Migrant Health: An Analysis. *Primary Care Focus*, July/August 1982, pp. 6-23. Published by the National Association of Community Health Centers, Inc., 1625 "I" St., N.W. Suite 420, Washington, D.C. 20006 (phone: 202-833-9280).

Johnston, H.: *Health for the Nation's Harvesters: A History of the Migrant Health Program in its Economic and Social Setting*. Farmington Hills, MI: National Migrant Worker Council, 1985. Available from N.M.W.C., Inc., Editorial Office, 617 W. Wayne St., South Bend, IN 46625 for $8.95. Appendix II briefly describes some farmworker health studies conducted between 1938 and 1982.

Kaufman, M., Lewis, E., Hardy, A.V., et al.: *Families of the Fields: Their Food and Their Health*. Monograph Series No. 13. Jacksonville, FL: Division of Health, Department of Health and Rehabilitative Services, State of Florida, 1973.

Lyndon B. Johnson School of Public Affairs: *The Health of Mexican-Americans in South Texas*. Policy Research Project No. 32, The University of Texas at Austin, 1979.

Migrant and Rural Community Health Association: Unpublished data on most frequent diagnoses for migrant and non-migrant patients, 1978. MARCHA, P.O. Box 130, Bangor, MI 49013 (phone: 616-427-7937).

Mines, R. and Kearney, M.: *The Health of Tulare County Farmworkers: A Report of 1981 Survey and Ethnographic Research for the Tulare County Department of Health*. April 15, 1982. For information, contact: Richard Mines, Agricultural Economist, Program in U.S.-Mexican Studies, University of California, San Diego, CA or Michael Kearney, Medical Anthropologist, Department of Anthropology, University of California, Riverside, CA.

Murphy, R.: Telephone conversation of October 17, 1985 with Robert Murphy, Director, Division of Health Examination Statistics, National Center for Health Statistics, Prince Georges Center Bldg., Room 2-58, 3700 East-West Highway, Hyattsville, MD 20782 (phone: 301-436-7068).

Olsen, D.M.: Health Problems and Disabilities Related to Environmental and Occupational Hazards of the Migrant Lifestyle. In: *Rehabilitation of Handicapped Migrant and Seasonal Farmworkers* (O.A. Rivera and R. Cespedes, eds.), 1982. Published by: The Institute for Human Resource Development, 263 South 1000 East, Salt Lake City, UT 84102.

Olsen, D.M. and Kane, R.L.: Final Report of the Utah-North Dakota Migrant Chronic Disease Screening Report. The University of Utah, March 1, 1976a. Unpublished report available from Dr. Donna Olsen, Utah Migrant Health Project, Utah Rural Development Corporation, 12 East Center Street, Midvale, UT 84047.

Olsen, D.M., Kane, R.L., and Proctor, P.H.: A Controlled Trial of Multiphasic Screening. *New England Journal of Medicine* 294(17): 925-930, 1976b.

Pollack, S.L. and Jackson, W.R., Jr.: *The Hired Farm Working Force of 1981*. Washington, D.C.: U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 507, November 1983.

Reig, S.M.L.: 1984 statistics provided by Sonia M. León Reig, Deputy Director, Office of Migrant Health, Bureau of Health Care Delivery and Assistance, Parklawn Building, Room 7A-55, 5600 Fishers Lane, Rockville, MD 20857 (phone: 301-443-1153), 1985.

Slesinger, D.P. and Cautley, E.: Medical Utilization Patterns of Hispanic Migrant Farmworkers in Wisconsin. *Public Health Reports* 96(3):255-263, 1981.

Sparta Health Center: Unpublished data. Sparta Health Center, 10255 Sparta Avenue, Sparta, MI 49345 (phone: 616-887-8831).

State University of New York at Buffalo: *The Health Care Needs and Economic Impact of Migrant Farmworkers: The Oak Orchard Service Area. A Descriptive Profile and an Assessment*. February 1984. Available from Oak Orchard Community Health Center, 80 West Avenue, Brockport, NY 14420.

Trotter, R.T., II: Project HAPPIER Final Report of Survey Results: Migrant Family Survey. September 21, 1984. Copies available from: Project HAPPIER, Pennsylvania Department of Education, 333 Market Street, Harrisburg, PA 17126-0333 (phone numbers: 1-800-233-0306 or in Pennsylvania 1-800-222-1936 or 717-783-7093).

U.S. Department of Agriculture: *Hired Farmworkers: Background and Trends for the Eighties*. Rural Development Research Report Number 32. Washington, D.C.: Economic Research Service, 1981.

U.S. Department of Health, Education and Welfare: *Vital and Health Statistics: Data from the National Health Survey*. DHEW (NCHS) Publication No. 1000, Series 11, No. 9, 1965.

U.S. Department of Health and Human Services: The Hispanic Health and Nutrition Examination Survey: Fact Sheet. DHHS Publication No. (PHS) 83-1287, March 1983.

Viavant, P., Ratcliffe, S., and Olsen, D.M.: Male Screening Project: Final Report, November, 1983. Unpublished paper available from Dr. Donna Olsen at the Utah Migrant Health Project, Utah Rural Development Corporation, 12 East Center Street, Midvale, UT 84047.

VI. Health Effects Of Poor Field Sanitation

A variety of health problems can result from unsanitary living and working conditions. In this section, data from migrant health programs in Colorado, Utah, and Indiana on the incidence of sanitation-related diseases among migrant farmworkers are presented. Comparison data with non-migrant patients in Utah and Indiana show that migrant farmworker patients suffer significantly higher rates of such diseases. In addition, employer perception of the extent and severity of health problems among migrants is not consistent with the clinical data.

Agricultural workers are the only occupational group in the United States who are denied the *federal* legal right to have sanitary facilities and drinking water provided at the worksite. Fourteen states, however, have enacted their own field sanitation laws, which are outlined in chapter XIX, "Occupational Safety and Health Laws Affecting Farmworkers." At the 1984 Occupational Safety and Health Administration (OSHA) hearings on a proposed federal field sanitation standard, numerous farmworkers and other witnesses across the country, including even those from states that have field sanitation laws, testified to the fact that there was a consistent lack of toilets, handwashing facilities, and adequate potable water at farm worksites. In a 1984 analysis, it was estimated that only 22-45% of hand labor-intensive farmwork nationwide (as measured in person-years) is performed at sites where management provides sanitary facilities and drinking water. On the other hand, it was estimated that 37% of hand labor-intensive farmwork (in person-years) is currently performed at sites without toilets, 21% without drinking water, and 55% without handwashing facilities (Centaur Associates, Inc., 1984).

A variety of health problems can result from poor sanitation. In the fields, the absence of sanitary facilities and clean drinking water can contribute to the spread of communicable diseases as well as the incidence of skin rashes, heat disorders, urinary tract infections, and pesticide-related illness. (These health problems are discussed in Chapters VII through XI). In addition, some accidents such as falls from ladders or eye injuries may be related to the lack of sanitary facilities — a worker might lose consciousness due to heat stroke from dehydration and fall off a ladder, or may suffer eye injury from dust or pesticides because water was not available to flush the eyes. Some of these problems — such as heat stroke — are life-threatening. Migrant farmworkers are especially at risk of sanitation-related illnesses because too often their housing also is overcrowded, unsanitary, or without basic amenities such as running water or screens (Porter, 1980; Ackerman and Simkovic, 1983).

While there are no data that estimate the amount of farmworkers' illness due to poverty-level living conditions versus the amount of illness related to the workplace environment, some health problems are more clearly work-related (e.g., heat stroke and pesticide poisoning). In addition, given that in the summer months, farmworkers often stay in the fields 10-12 hours or more per day, six or seven days a week, it is not unreasonable to assume that the lack of sanitation at the workplace is a factor that adversely affects their health and their families' well-being.

In this chapter incidence data on sanitation-related disease from three migrant health programs are presented. This information was entered into the OSHA field sanitation record during May and June of 1984.

Migrant Health Clinic Data

Colorado

Mr. Chuck Stout, Director of the Migrant Health Program of the Colorado Department of Health, testified that 14.3% (731/5,102) of all conditions treated in his program in 1983 were related to inadequate sanitation. He also pointed out that many of the sanitation-related health problems may never even come to the attention of a health care provider; thus, the incidence rate is probably underestimated throughout the migrant farmworker population in general.

In Table 29, the breakdown of sanitation-related clinic encounters is presented. These data do not include another 5,849 farmworker patients who also were served by two other migrant health centers in Colorado. No breakdown by age or sex was provided nor were data available to compare the incidence of sanitation-related diseases in other sectors of the Colorado population.

Utah

Olsen et al. (1984) compared migrant farmworkers in Utah with a sample of low-income patients in Salt Lake City. They conducted a chart audit of migrant patients who were seen more than once during the period 1982 to May 1984 in four of the six migrant clinics in the state. Two of the clinics served farmworkers harvesting orchard crops (Brigham City and Provo); the other two served migrants working in row crops (Midvale and Beryl Junction). The purpose of the chart review was to determine the incidence of water- and sanitation-related symptoms and diseases among the migrant farmworker patient population and compare the data with data from another low-income population that did have available sanitary facilities.

The patient records were screened for symptoms that could indicate common fecal-contamination diseases such as shigellosis, giardiasis, or the presence of *E. coli*, *Campylobacter* or *Salmonella*. These symptoms include: diarrhea, nausea and/or vomiting, intestinal or abdominal pain, nonspecific gastroenteritis, bloody stools, or fever of unknown origin. If an accompanying diagnosis that ruled out a water-related disease was present (e.g., nausea and vomiting reported in a pregnant patient), the case was not included in the statistics. Cases of tuberculosis and helminthic intestinal parasites — as indicators of general sanitation — and urinary tract infections were, however, included.

TABLE 29
CONDITIONS ASSOCIATED WITH INADEQUATE SANITATION PRACTICES
MIGRANT HEALTH PROGRAM
COLORADO DEPARTMENT OF HEALTH
1983*
N = 5,102**

	No. of Cases	*Total*
Digestive System		
Diarrhea	58	
Gastroenteritis	99	
Intestinal Disorder, Unspecified	93	
***Other	110	360
Genitourinary System		
Urinary System Disorder	36	
Urinary Tract Infection	67	103
Infections & Parasitic Disease		
Giardia	3	
Hepatitis	39	
Infectious Intestinal Disorder	8	
Parasitic Disease, Unspecified	14	
Strep Throat	135	
***Other	69	268
	TOTAL	731

*Testimony presented by Chuck Stout, M.P.H., Director, Migrant Health Program, at OSHA field sanitation hearing, Washington, D.C., May 23, 1984. Entered into the OSHA field sanitation record Docket No. H-308, Exhibit No. 20. Mr. Stout's address is: Colorado State Health Department, 4210 E. 11th Avenue, Denver, CO 80220 (phone: 303-331-8200).

**There were a total of 4,574 patients who were diagnosed 5,102 times by general practice physicians and mid-level providers.

***The code "Other" is used by physicians and mid-level providers when the provider strongly suspects an illness within the category, but is not able, for a variety of reasons, to obtain laboratory confirmation of a specific diagnostic code.

These rates were compared to data from a Salt Lake City clinic that served poor urban patients, whose data were obtained from computerized billing files. The authors reported that it was not possible to eliminate all those whose diagnoses would have ruled out water-related diseases; therefore, reporting of symptoms for the urban poor group was overestimated.

The migrant farmworker and urban patient groups were classified as low-income according to federal guidelines. The two populations differed by race, age, and sex: more than half of the Salt Lake City patients were white; 13% were Hispanic, and 2% were Native American. The rest of the urban patients were black, Asian, and Pacific Islanders. The migrant group was predominantly Hispanic (75%), although 20% were Native American, and the remainder were mostly white, Asian, and black. This composition is distinct from East Coast migrants who are typically American black, Caribbean (e.g., Puerto Ricans, Jamaicans, Haitians), and Hispanic.

The urban clinic population was only 36% male compared to 51% of the migrants; this would indicate that the urban population would be more likely to have higher rates of urinary tract infections, which are more common in women.

More of the Salt Lake City urban group (23%) used clinic services in the 0-4 year age group compared to the migrants (17%). This particular age group is the most susceptible to illness and death from infectious diseases associated with poor sanitation.

The migrant clinic chart audit included 936 patients, while the urban clinic chart review included 8,968 users with a total of 14,653 encounters during calendar year 1983. (Table 30 presents the comparison of the migrant farmworker versus urban patients.)

TABLE 30
EPISODES PER 1000 PATIENTS OF SANITATION AND WATER-RELATED SYMPTOMS AND DISEASES IN UTAH MIGRANT FARMWORKERS AND URBAN POOR***

Symptoms/Diseases	*Migrants**	*Urban Poor***
Non-specific diarrhea	153	8
Abdominal/intestinal pain including shigellosis and giardiasis	66	10
Nausea and/or vomiting	51	4
Non-specific gastritis/gastroenteritis	26	0
Bloody stools	9	1
Fever of unknown origin	37	0.3
Urinary tract infection	41	14
Tuberculosis	19	0.8
Helminthic infestation	28	0.8

*Data from Brigham City, Midvale, Provo and Beryl Junction Clinics, Utah Migrant Health Project. N = 936.

**Data from the Urban Health Initiative Clinics, Salt Lake City, UT. N = 8,968.

***Olsen et al. (1984).

Diarrhea occurred 20 times as often among migrants as among the urban poor. Nausea and vomiting were 13 times as frequent, and gastroenteritis, abdominal or intestinal pain, and bloody stools six to 26 times as frequent among the farmworker population. Fevers of unknown origin occurred 120 times as frequently in the migrants. Tuberculosis was 24 times as frequent in the migrants, and helminthic infestations 35 times as frequent, all of which indicated that the general sanitation and hygiene level in the migrant farmworkers was far below that of the urban poor comparison group. Urinary tract infections occurred three times as frequently in the migrants as in the urban poor, which is notable given the fact that, in this study, a higher percentage of the urban population was female (64% versus 49%).

The actual size of the disparity between the migrants and urban poor for symptoms occurring at low frequencies (e.g., bloody stools) or diseases infrequently diagnosed (e.g., tuberculosis) is debatable. What is obvious, however, is that the migrant patients consistently presented at the clinics more often with symptoms or diseases that can be attributed to poor sanitation, inadequate hygiene, or impure drinking water.

Olsen et al. (1984) also conducted a survey of farmers employing migrant farmworkers served by the four clinics. Sixty-five of the 107 farmers contacted admitted to employing migrants and agreed to participate in the survey while 36 denied employing migrants, and six refused to answer questions.

The authors suggested that the results of the farmer survey may provide an explanation for the higher rate of sanitation-related symptoms and diseases among migrants. It is clear that the farmers did not accurately perceive the health problems of farmworkers or the sanitary conditions that led to those problems.

- Thirty percent (30%) of farmers thought that the health conditions of migrant farmworkers needed improvement, yet only 11% believed that migrants had any serious health problems.
- Only 18% said that diarrhea was a significant health problem among the migrants, and most stated that it was a result of eating cherries.
- Only one farmer stated that migrant farmworkers or their children had a significant problem with nausea, vomiting, or fever.

These responses are particularly significant, indicating the Utah farmers' lack of awareness of the migrants' virtual epidemic health problems. The authors also pointed out that the migrant clinic data underestimated the actual frequency of disease in the migrant population because farmworkers, particularly male farmworkers, do not seek medical attention unless they are in great pain or quite unable to work.

Indiana

At its four clinic sites, Indiana Health Center, Inc., with headquarters in Indianapolis, provided health services to 2,570 migrant and seasonal farmworkers and 4,617 local community residents who were not involved in farm labor during calendar year 1983. A review of 1983 patient records showed that the farmworker patient population suffered higher rates of sanitation-related diseases when compared to the local residents. (These data are shown in Table 31.)

- Eye problems occurred seven times as frequently as in the local residents;
- Urinary tract infections were almost three times as frequent among the farmworkers;
- Dermatitis or skin inflammation occurred four and a half times as frequently as in the non-farmworkers; and
- Gastroenteritis was diagnosed over six times as frequently among the farmworkers.

In addition, among the farmworkers there were 113 cases of parasite infestations and two cases of heat stress recorded during 1983; the incidence of these two health problems among non-farmworkers was not stated in the report.

The statistics presented in this chapter highlight the range of health conditions that may result from or be exacerbated by poor workplace sanitation. In the next five chapters we will consider in more depth the following health problems that are most directly related to poor field sanitation: communicable diseases, urinary tract infections/kidney problems, heat stress, pesticide-related illness, and dermatitis.

TABLE 31
COMPARISON OF DIAGNOSES, FARMWORKERS VERSUS NON-FARMWORKERS
INDIANA HEALTH CENTER, INC.
1983*

Diagnosis	*No. Farmworkers (N=2570)***	*No. Non-Farmworkers (N=4617)*	*Total*	*% Total*	*Incidence (Per 100)*
Eye problems .... (conjunctivitis, conjunctival ... hemorrhage, stye, swelling, unspecified)	97	25	122	79.51M 20.49N	3.77M 0.54N
Urinary tract infection	107	66	173	61.85M 38.15N	4.16M 1.43N
Dermatitis, unspecified	117	47	164	71.34M 28.66N	4.55M 1.02N
Gastroenteritis................	88	25	113	77.88M 22.12N	3.42M 0.54N

*Based on data of July 2, 1984 entitled "1983 Incidence of Selected Diagnoses, Migrant and Community Clients." Contact: Patricia A. Newhouse, M.D., Medical Director or Ms. Lynn Clothier, Executive Director, Indiana Health Center, Inc., 129 E. Market St., Suite 1010, Indianapolis, IN 46204 (phone: 317-632-1231).

**Includes migrant and seasonal farmworkers.

REFERENCES CITED

Ackerman, A. and Simkovic, J.: *Final Report — Special Migrant Initiative: 1982 Survey to Compare the Health Status of Migrants with Local Residents*. Published by Sunrise Community Health Center, Inc., 1028 5th Avenue, P.O. Box 1870, Greeley, CO 80632. April 1983.

Centaur Associates, Inc.: *Final Report: Baseline Analysis and Economic Impacts of Proposed Field Sanitation Standard*. April 1984. Entered into the OSHA field sanitation record, Docket No. H-308 as Exhibit No. 11-017. See also Exhibit No. 21, testimony by John Birdsong of Centaur Associates, Inc. on May 23, 1984, Washington, D.C.

Newhouse, P.A.: 1983 Incidence of Selected Diagnoses. Migrant and Community Clients. July 2, 1984. Contact: Ms. Lynn Clothier, Executive Director, Indiana Health Center, Inc., 129 E. Market St., Suite 1010, Indianapolis, IN 46204 (phone: 317-632-1231).

Olsen, D.M., Weidner, B.L., and Brett, M.A.: Water and Sanitation-related Disease and Field Sanitation Practices in Utah: Additional Comments and Preliminary Findings Submitted in Support of the OSHA Field Sanitation Standard. July 27, 1984. Available from the authors: Utah Rural Development Corporation, 12 East Center Street, Midvale, UT 84047 (phone: 801-566-1683). Submitted to the OSHA field sanitation record, Docket No. H-308.

Porter, P.A.: The Health Status of Migrant Farmworkers. March 1980. New York: The Field Foundation, 100 E. 85th Street, New York, NY 10028 (phone: 212-535-9915).

Stout, C.: Testimony Prepared for Hearings on Proposed Field Sanitation Standards by the Occupational Safety and Health Administration. May 23, 1984. Exhibit No. 20 of OSHA field sanitation record, Docket No. H-308. Contact: Mr. Chuck Stout, Director, Division of Migrant Health, Colorado State Health Department, 4210 E. 11th Avenue, Denver, CO 80220 (phone: 303-331-8200).

VII. Communicable Diseases

Migrant and seasonal farmworkers are susceptible to numerous infectious diseases. The lack of proper sanitary facilities in the home and the workplace contributes to the spread of such diseases.

Diseases related to poor sanitation include dysentery, hepatitis, typhoid fever, and other respiratory, skin, and intestinal ailments. Diseases are commonly spread by using the same eating and drinking utensils, drinking non-potable water — potable water being unavailable, — and fecal-oral contamination from the lack of toilet and handwashing facilities. Since many crops are packaged directly in the fields, and some disease organisms (e.g., parasite eggs) are very hardy, washing the produce may not remove these organisms, and the potential exists for crop contamination and the transfer of diseases to the consumer.

The few extant studies of migrant farmworker children and adults show them to have higher rates of parasitic (such as worm and protozoan) infections than either the general U.S. population or even other rural or poor urban populations. The rate of infection among migrants is estimated to be twenty times that of the general U.S. population.

Untreated parasitic conditions can lead to chronic anemia or malnutrition in both children and adults. The effects of parasitic infections on the human fetus are not fully understood, but low birth weight may well be one result. Barefoot farmworkers and children are at risk of contracting worm infections in areas where human or animal excrement is not disposed of properly.

Tuberculosis is a particular problem among migrants. For example, for non-whites in North Carolina's six major farmworker counties, tuberculosis rates were three to seven times higher than the average state-wide rate of 17.4 cases per 100,000. Treatment is lengthy and costly, and in a mobile population, monitoring of patients and their families is extremely difficult.

A primary tenet of public health is that poor hygiene results in poor health and ultimately, illness. Substandard, unsanitary housing contributes to the spread of contagious diseases. The lack of toilets, handwashing facilities, and safe drinking water at the worksite further increases the risk of sanitation-related diseases among farmworkers. These diseases primarily affect the intestinal tract, respiratory system, skin, and general nutritional well-being.

Infections Spread By Fecal-Oral Contamination

Disease-causing organisms can be transmitted via fecally contaminated food, water, or objects from hand to mouth (i.e, fecal-oral contamination). Bacterial, viral, and parasitic (protozoan and worm) infections may be spread in this manner. Among farmworkers, these diseases may be spread by drinking or washing in contaminated water, such as irrigation ditches. If farmworkers have no way to wash their hands after defecating, they can ingest disease-causing organisms when they eat or smoke and spread the organisms among fellow workers. Without field toilets and handwashing facilities available, contamination of the crops with human waste occurs. These microbes may be transmitted to the consumer since some pathogens (disease-causing organisms) such as parasite eggs are very hardy, and many crops are now being packaged immediately in the fields. In some cases (e.g., in *Giardia lamblia*) even washing the produce with chlorinated water will not remove the contaminating organisms.

Where there are no toilets, and human waste is not properly disposed of, disease also can be spread by animal vectors; for example, flies can spread dysentery and typhoid from human excreta to food or to parts of the human body. In addition, workers or children who are barefoot in areas where there is exposed animal or human excrement run the risk of contracting worm infections such as hookworm or strongyloides.

Diarrhea is a common symptom of most fecal-oral diseases. Those spread by fecally contaminated water include cholera, typhoid fever, amebic dysentery, shigellosis or bacillary dysentery, as well as pathogens causing nonspecific or viral diarrheas, such as campylobacteriosis, salmonellosis, yersiniosis, infectious hepatitis (hepatitis A), *Escherichia coli* diarrhea, and giardiasis. The symptoms and consequences of these diseases are discussed below (see Benenson, 1975).

Intestinal parasites can be detected through examination of stool samples.

Cholera

This is a serious acute intestinal disease characterized by sudden onset, profuse watery stools, vomiting, rapid dehydration, acidosis, and circulatory collapse. Death may occur within a few hours of onset of the disease. Fatality rates in untreated cases may exceed 50%, although, with proper treatment, they are less than 1%. Mild cases suffering only diarrhea are common, especially in children. Wholly asymptomatic infections are many times more frequent than clinically recognized cases. The disease-causing agent is *Vibrio cholerae*.

Except for two laboratory-acquired cases in 1966, there were no reports of indigenous cholera in the Western Hemisphere between 1911 and 1972. In 1973, however, a case in Texas with no known source was reported.

Typhoid Fever

This systemic infectious disease (caused by the bacteria *Salmonella typhosa*) causes the following symptoms: continued fever, headache, malaise, anorexia, slowed heart rate, enlargement of the spleen, rose spots on the trunk, and constipation. Non-sweating fever, mental dullness, and slight deafness may also occur. The usual fatality rate of 10% is reduced by antibiotic therapy to 2-3% or less.

In 1973, an outbreak of typhoid occurred in several migrant labor camps in South Dade County, Florida, due to contaminated drinking water and unsanitary conditions (U.S. House of Representatives Subcommittee on Agricultural Labor, 1974).

Dysentery

There are two types of dysentery: amebic dysentery or amebiasis and bacillary dysentery or shigellosis.

Amebic dysentery results from infection with a protozoan parasite (*Entamoeba histolytica*). Symptoms vary from fever, chills, and blood or mucoid diarrhea to mild abdominal discomfort with diarrhea containing blood or mucus alternating with periods of constipation or remission. Liver abscesses are a chronic effect of amebic dysentery.

Shigellosis or bacillary dysentery is an acute bacterial disease primarily involving the large intestine; it is caused by any of the four species of the genus *Shigella*. Symptoms include diarrhea, fever, vomiting, cramps, and painful straining at defecation or in urination. In a typical outbreak there also are mild and asymptomatic infections. The severity of illness and the fatality rate are largely functions of the patient's age, the pre-existing nutrition state, the sanitation level (or the size of the infecting dose), and the type of predominant organism in the outbreak. In hospitalized patients without supportive therapy, the fatality rate may exceed 20%.

Salmonellosis

Numerous strains of the bacteria *Salmonella* cause disease in both humans and animals. Salmonellosis is an acute infectious disease characterized by sudden onset of abdominal pain, diarrhea, and nausea and vomiting. Dehydration, especially among infants, may be severe. Fever is nearly always present, and anorexia and loose bowels often persist for several days. In rare cases the infectious agent may lodge in any tissue of the body, producing abscesses and causing arthritis, cholecystitis (infection of the gall bladder) endocarditis, meningitis, pericarditis, pneumonia, pyoderma (pus-causing skin disease), or pyelonephritis (kidney infection). Death is uncommon except in the very young or very old or in debilitated persons. Transmission is generally caused by eating food contaminated by animal or human feces; however, in 1965 a severe epidemic (over 15,000 cases) of *S. typhimurium* diarrhea in Riverside, California resulted from contamination of the unchlorinated public deep water supply.

Yersiniosis

This acute intestinal disease is caused by two distinct bacteria: *Yersinia enterocolitica* and *Y. pseudotuberculosis*. Signs and symptoms are often similar or indistinguishable, including diarrhea, enterocolitis, mesenteric lymphadenitis (abdominal swelling) mimicking appendicitis, low-grade fever, headache, pharyngitis, anorexia, vomiting, arthritis, skin ulceration, abscesses, and septicemia (blood poisoning).

The mode of transmission of *Yersinia* has not been determined, although it is most likely due to direct fecal-oral contact with infected persons or animals or indirect contact by eating or drinking fecally contaminated raw food and water.

Infectious Hepatitis (Hepatitis A)

The onset of this viral disease is usually abrupt, with fever, malaise, anorexia, nausea, and abdominal discomfort, followed within a few days by jaundice. Infectious hepatitis varies from a mild illness lasting one to two weeks to a severely disabling disease lasting several months. Recovery usually requires a prolonged period of time. In general, severity of the disease increases with age, but complete recovery without aftereffects or recurrences is the rule. Many cases are mild and without jaundice, especially in children, and outbreaks are common in rural areas.

Data from the Centers for Disease Control for 1981 show a national incidence rate of three cases per 10,000. Those states with a high migrant farmworker population were also the states reporting the highest incidence of hepatitis; Florida, Texas, and California together accounted for 39.3% of all hepatitis cases reported in 1981 (Ortiz, 1984).

Acute Undifferentiated Diarrhea

This clinical syndrome, frequently of unknown cause, presents most often with loose stools and fever. It may include specific infectious diseases such as cholera, shigellosis, salmonellosis, amebiasis, enteropathogenic *E. coli* infections, or acute viral gastroenteritis. It may also be caused by other viruses, helminths (worms), or protozoa.

Enteropathogenic *Escherichia coli* are of two types — invasive and enterotoxic or toxin-producing. Invasive strains are similar to *Shigella*: disease is primarily localized in the colon, and symptoms include fever and mucoid or sometimes bloody stools. Enterotoxic strains cause reactions more like those of cholera, producing a profuse watery diarrhea without blood or mucus. Abdominal cramping, acidosis, prostration, and dehydration are common; fever may or may not be present. Both invasive and enterotoxic strains may cause epidemic and sporadic disease. Newborns are most susceptible, in whom fatality rates may range from 0-40%. Older children and adults also may be affected but with less dire results.

Giardiasis

Infections with the protozoa *Giardia lamblia* are frequently asymptomatic. Patients who develop clinical illness usually have a protracted, intermittent, frequently debilitating, foul-smelling diarrhea associated with flatulence, abdominal distention, and anorexia. Anorexia with demonstrable malabsorption leads to significant weight loss in many patients (Tidwell, 1984). The carrier rate in different parts of the United States may range between 1.5-20%, depending on the community and age group surveyed. The Centers for Disease Control reported that 4% of more than 300,000 stool samples submitted to state laboratories during 1977 contained this parasite (Centers for Disease Control, 1978).

Helminthic (Worm) Infections

Worm infections can create a serious health hazard, causing anemia, malnutrition in children, and major weight loss in adults. The nutritional status of those who are at risk is important. Animal experiments with a number of worm infections, especially those with *A. caninum* in the dog and the closely related *Nippostrongylus muris* in rats, have revealed that the nutritional status of the host has a powerful influence on his ability to combat the infection (Dull and Dowdle, 1973). In addition, worms can puncture the alveoli and make the lungs more susceptible to infections such as viruses, bacteria, and tuberculosis.

Worms that most commonly infect people in the United States are: *Ascaris lumbricoides*, whipworm (*Trichuris trichiura*), hookworm (*Necator americanus* and *Ancylostoma duodenale*), and *Strongyloides stercoralis*. Ascariasis and whipworm are spread by ingestion of the infective eggs, most commonly from salads and other foods eaten raw. In the case of strongyloidiasis and hookworm, transmission occurs when infective larvae in the soil penetrate bare skin, usually the foot.

Ascariasis

This is a worm infection of the small intestine. In the United States, the disease is most prevalent in the South: in rural South Atlantic states, the incidence is as high as 6%, and in selective populations in these states, it is over 35% (Myers, 1980).

Symptoms are variable, often vague or absent and ordinarily mild; live worms passed in stools or vomited are frequently the first recognized sign of infection.

Heavy parasite burdens may cause digestive and nutritional disturbances, abdominal pain, vomiting, restlessness, and disturbed sleep. Serious complications among children, especially in unsanitary areas of tropical countries, include bowel obstruction and, occasionally, death due to migration of adult worms into the liver, gallbladder, peritoneal cavity or appendix, and more rarely, from perforation of the intestine.

The eggs of *Ascaris* can survive in the soil for years.

Whipworm (*Trichuris trichiura*)

This roundworm infection of the large intestine is often asymptomatic and is detected only by examination of the feces. Heavy infections result in intermittent abdominal pain, bloody stools, diarrhea, and loss of weight. Light infections generally produce little damage and no symptoms.

Hookworm (*Necator americanus*, *Ancylostoma duodenale*)

In the United States, hookworm generally refers to the species *Necator americanus*. In 1972, it was estimated that 700,000 people in the United States harbored hookworms, especially in areas of the rural South where environmental conditions favor survival of hookworm eggs in the soil (Centaur Associates, Inc., 1983).

The vague symptoms of this chronic, debilitating disease vary greatly according to the degree of anemia. The blood-letting activity of the worm, along with malnutrition, leads to hypochromic microcytic anemia, a major cause of disability. This condition is characterized by a disproportionate reduction of red cell hemoglobin, the oxygen-carrying component in the blood.

Children with heavy, long-term infection may be retarded in their mental and physical development. Death is infrequent in either the acute or chronic stages, and even then, it usually occurs in association with other infections. Light hookworm infections generally produce few — or no — clinical effects.

Strongyloidiasis

The clinical signs of this intestinal worm infection include: dermatitis when the larvae of the parasite penetrate the skin, cough and rales, or even benign pneumonia when they pass through the lungs, and abdominal symptoms when the adult females lodge in the mucosa of the intestine.

The symptoms may be mild or severe, depending upon the intensity of the infection and include, in order of frequency, pain, nausea, weight loss, vomiting, diarrhea, weakness, and constipation. Rashes may occur, especially after reinfection.

Data On Enteric (Intestinal) Diseases Among Farmworker Populations

Ortiz (1984) analyzed the OSHA field sanitation record and calculated that migrant farmworkers were at twenty times higher risk of getting a parasitic infection than was the general U.S. population. Their risk of contracting gastroenteritis and infectious diarrhea was eleven times greater, and they were 300 times more likely to develop infectious hepatitis.

In the rest of this section, farmworker studies are presented by state.

Massachusetts

Ortiz (1980) surveyed 377 Puerto Rican farmworkers and their children in western Massachusetts for prevalence of parasites. Stool examination revealed a rate of parasites of 35.5%, almost twice as high as the rate in a Puerto Rican population living in Chicago (Winsberg, 1975). Two cases of hookworm infections were detected in children born in the United States who had never travelled outside the area, which confirmed the belief that ample opportunity exists for the transmission of pathogenic parasites on farms. (Table 32 presents the infestation data for the population under age 15 in the Ortiz study.)

Dr. Jesse Ortiz, Associate Professor of Environmental Health, University of Massachusetts at Amherst, expanded on his study data regarding the adults with parasitic infections (16/57 or 28.7%) when he appeared as an expert witness for OSHA at the field sanitation hearing in Washing-

TABLE 32
RATES OF PARASITE INFECTION AMONG CHILDREN*

Parasite	*Number of All Positive Cases*	*%*	*Prevalence per 100 Children under Age 15 for Individual Parasites*
Trichuris trichiura	98	65	31
Hookworm	17**	11	5
Giardia lamblia	13	9	4
Entamoeba coli	6	4	2
Endolimax nana	5	3	2
Ascaris lumbricoides	8	5	3
Schistosoma mansoni	2	3	1
Strongyloides stercoralis	2	3	1
Total Cases	151***	100	—

*Ortiz (1980), p. 1104.

**Includes two children born in the United States who had never traveled outside the Northeastern United States.

***The difference between the number of positive subjects (118) and the number with parasites (151) is due to the fact that many subjects had more than one parasite.

ton, D.C., May 23, 1984. The most common parasites found in the adult population were, in order, *Trichuris* (or whipworm), *E. coli*, hookworm, *Ascaris*, *Schistosoma*, and *E. nana*. All of the parasites that were found in adults also were common in children. *Giardia*, which was not found in the adults in this survey, was shown to be quite prevalent among the children. Only three adults were infected by two types of parasites, and one adult had a multiple infection. In contrast, there were 30 children with double infections, and 13 had multiple infections.

Schistosomiasis or bilharziasis is a blood fluke infection in which adult male and female worms live in the veins of the host. The disease is contracted while working, swimming, or wading in water infested with the free-swimming larvae, which need appropriate snail hosts for their development. These are not found in the United States, although rivers and lakes in Puerto Rico are contaminated with *Schistosoma mansoni*, which causes dysentery and a spiking fever. Chronic infestation causes such life-threatening conditions as cirrhosis and pulmonary fibrosis as the worms penetrate the liver and lungs.

Entamoeba coli, *Endolimax nana*, and *Iodomoeba williamsi* or *Iodomoeba butchlii* (see Arizona statistics by Tidwell later in this section) are generally considered nonpathogenic. Their presence is an indicator of poor hygiene. Stauffer and Levine (1974) have reported two cases of chronic diarrhea attributable to *E. nana*. Also, the presence of these amebae are of concern in that they may mask the presence of the pathogen *Entamoeba histolytica* (Dull and Dowdle, 1973).

Dr. Ortiz compared the prevalence of various parasites among his study population with rates among special populations (such as in rural areas) in the United States (see Table 33). The total incidence of parasitic infections among the general U.S. population, however, is not high, between 1-2%.

TABLE 33
PREVALENCE RATES OF PARASITIC INFECTIONS REPORTED FOR SELECTED U.S. POPULATIONS VERSUS MIGRANT FARMWORKERS IN MASSACHUSETTS*

Parasite	*Rates*	
	*US/SP***	*Migrants*
Trichuris	14%	49%
Hookworm	3%	9%
Ascaris	4%	6%
Strongyloides	4%	0.5%
E. histolytica	ND	0.5%
Giardia	ND	12%
E. nana	ND	11%
Schistosoma	NA	2%
E. coli	ND	10%

*Data presented by Dr. Jesse Ortiz at OSHA field sanitation hearing, Washington, D.C., May 23, 1984. Entered into the OSHA field sanitation record as Exhibit No. 19, Docket No. H-308.

**U.S./Special populations.

ND = no data

NA = does not apply

North Carolina

In recent years, Tri-County Community Health Center, Newton Grove, has monitored the prevalence of parasitic conditions in both migrant farmworker children and pregnant women in conjunction with the Department of Parasitology, University of North Carolina, School of Public Health.

In Table 34, the 1983 migrant farmworker study results of children 0-12 years of age are presented. Almost 40% of the 236 patients screened positive for parasites. Whereas Ortiz found whipworm (*Trichuris*) to be the most common parasite in his juvenile population (65% were infected), the North Carolina researchers found *Giardia* the most prevalent parasite in the same age group (30.1%).

Almost three-fourths (73.3%) of these children were infected by a single type of parasite. Another 17.5% were infected by two types of parasites, while 7.2% had three types of parasites. Two percent (2%) of the children had four or five types of parasites.

Six children were found to have *Hymenolepis nana*, or dwarf tapeworm, which is relatively common, especially in children. Its entire cycle takes place within one host. This sometimes makes treatment difficult because eggs may hatch within the intestine and develop into new worms, thus causing autoinfection.

TABLE 34
PREVALENCE OF PARASITES AMONG MIGRANT FARMWORKER CHILDREN
TRI-COUNTY COMMUNITY HEALTH CENTER
NEWTON GROVE, NORTH CAROLINA
1983*

Parasite	*No. of Cases***	*Percent (%)*
Giardia lamblia	71	30.1
Ascaris lumbricoides	5	2.0
Trichuris trichiura	5	2.0
Hookworm	3	1.3
Hymenolepis nana	6	2.5
Entamoeba histolytica	2	0.8
Strongyloides	0	0.0
Taenia solium	1	0.5
TOTAL	93	39.4

*Data submitted to OSHA by Connie Gates, then Director, Tri-County Community Health Center, P.O. Box 237, Newton Gove, NC 28366 phone (919-567-6194)

**N = 236

One case of taeniasis, or tapeworm disease, was found. It is caused by eating raw or lightly cooked beef (*Taenia saginata*) or pork (*Taenia solium*). In the case of *T. solium*, infection also is caused by fecal-oral contamination. Frequently this non-fatal disease is asymptomatic. Clinical symptoms may include nervousness, insomnia, anorexia, weight loss, abdominal pain, and digestive disturbances. Although prevalence is low in the United States, in this hemisphere, the disease occurs frequently in Mexico and Peru.

When humans swallow eggs of the pork tapeworm, the eggs hatch in the small intestine. Cysticercosis results when the larvae grow in tissues, muscles, and vital organs of the body (e.g., the ear, eye, central nervous system, or heart) and convulsions may result. If they lodge in the eye, this can lead to retinal detachment. In Mexico, cysticercosis is a major neurological disease. In the United States, it is becoming a more visible problem in states that border Mexico (Richards et al., 1985). The condition is communicable for as long as the worm remains in the intestine, which can be many years (Tidwell, 1984).

In 1983 , Tri-County also looked at the rate of parasitic infection among its pregnant migrant farmworker population. Twenty-four (33.3%) of 72 prenatal patients had stool samples that tested positive for parasitic infections. (Table 35 provides a summary of the prenatal data.)

As in the pediatric patients, *Giardia* was the most commonly found parasite among the pregnant patients.

TABLE 35
PREVALENCE OF PARASITES AMONG PREGNANT MIGRANT FARMWORKERS
TRI-COUNTY COMMUNITY HEALTH CENTER
NEWTON GROVE, NORTH CAROLINA
1983*

Parasite	*% Infected***
Giardia lamblia	21.4
Entamoeba histolytica	7.0
Trichuris trichiura	7.1
Hymenolepis nana	7.1
Ascaris lumbricoides	7.1
Entamoeba coli	21.4
Dientamoeba fragilis	7.1

*Data submitted to OSHA by Connie Gates, then Director of Tri-County Community Health Center, P.O. Box 237, Newton Grove, NC 28366 (phone: 919-567-6194).

**N = 24

Dientamoeba fragilis also has been implicated as a causative agent of abdominal stress and diarrhea (Dull and Dowdle, 1973).

Little is known yet about the full effects of parasitic infections on the human fetus. There is some indication that low birth weight may be an outcome; however, any research on this subject must also take into account other problems such as genetic factors, malnutrition, other infections, and smoking (Edwards, 1984).

There are, however, some reports from clinics that support the hypothesis that parasitic infections have serious implications for fetal health. For example, one patient, who came to the clinic in her 34th week of pregnancy, showed poor weight gain, poor nutritional status, and low hematocrit and hemoglobin levels. She already had had three miscarriages and was found to be infected by five different types of parasites. Her baby was delivered by caeserean section, weighed 3 lbs. 9 oz. at birth, and had to remain in intensive care for five weeks and in intermediate care for another two to three weeks (Edwards, 1984).

Arizona

Robert A. Tidwell, M.D., then Medical Director of Clínica Adelante, Inc. in El Mirage, Arizona, submitted data to OSHA in 1984 on 217 farmworkers who were screened for parasites between 1982 and April 1984. Ninety-seven (97 or 44.7%) of the workers had stool samples that tested positive (see Table 36).

Of the 189 parasitic infections found in the 97 workers, 90 (48%) of them were pathogenic (*E. hartmanni*, *E. histolytica*, A. *lumbricoides*, *G. lamblia*, *T. trichiura*, *D. fragilis*, *H. nana*, and *S. stercoralis*). There were from one to four types of parasites in each specimen.

All but one of the parasites listed in Table 36 have been discussed previously. *Entamoeba hartmanni*, free-living bacteria found especially in damp soil near fresh water, are ubiquitous, surviving in cold as well as tropic and subtropic countries (Andujar, 1975). *Entamoeba hartmanni* infection is acquired by ingesting food or water contaminated with cyst-bearing feces (Beaver et al., 1984). The amebae, however, are highly soluble in bile, and therefore, it is highly unlikely that infection will occur by simple ingestion unless a person already has some specific alimentary tract disease (Andujar, 1975). Thus, presence of another parasitic infection would be a predisposing factor for *E. hartmanni* infection. This organism had been considered nonpathogenic, but eight case reports from Florida and Australia have revealed that *E. hartmanni* can cause a rapidly fatal form of meningitis called meningoencephalitis (Andujar, 1975). *E. hartmanni* is often misdiagnosed as *E. nana* and vice versa (Beaver et al., 1984).

TABLE 36
PARASITIC INFECTIONS AMONG FARMWORKERS CLINICA ADELANTE EL MIRAGE, ARIZONA 1982-1984*

Parasite	*No. of Cases (N = 189)*	*% of Infected (N = 97)*
Endolimax nana	54	55.7
Entamoeba coli	38	39.2
Entamoeba hartmanii	37	38.1
Entamoeba histolytica	27	27.8
Ascaris lumbricoides	12	12.4
Giardia lamblia	6	6.2
Iodamoeba butchilii	4	4.1
Taenia	3	3.1
Trichuris trichiura	3	3.1
Dientamoeba fragilis	2	2.1
Hymenolepis nana	2	2.1
Strongyloides stercoralis	1	1.0

*Data submitted as written comments to OSHA by Robert A. Tidwell, M.D., then Medical Director of Clinica Adelante, Inc., P.O. Box 760, El Mirage, AZ 85335 (phone: 602-933-9671).

Illinois

In 1975, Tulsky and Lichter, physicians at the Abraham Lincoln School of Medicine, University of Illinois, studied 145 asymptomatic Mexican-American children between the ages of 2-12 for parasitic infestation; 113 children lived with their parents in one of the seven temporary labor camps in Rochelle, Illinois; 32 were children of settled-out migrants, i.e., seasonal farmworkers, and lived in town.

The study findings were as follows:

(1) The prevalence of intestinal parasites among these children was 27.5% (40/145).
(2) The rate of parasites among the children living in the camps (30.9%) was almost twice that of the children living in town (15.6%).
(3) Almost 20% (28/145) of the children with parasites had a single infection; 6.8% (10/145) had a double infection and 1.3% (2/145) a triple infection.
(4) *Giardia lamblia* was the most prevalent of all the intestinal parasites; it was found in 30 children (20.6%).
(5) All parasite-infected children of settled-out migrants had a single infection of *Giardia*.

Table 37 shows the rates of infection of seven parasites among these children.

TABLE 37
PREVALENCE OF INTESTINAL PARASITES AMONG FARMWORKER CHILDREN ROCHELLE, ILLINOIS - 1975*

Parasite	*Frequency (N = 145)*	*Percent (%)*
Giardia lamblia	30	20.6
Hymenolepis nana	9	6.2
Ascaris lumbricoides	4	2.7
Strongyloides stercoralis	4	2.7
Enterobius vermicularis**	4	2.7
Entamoeba histolytica	2	1.3
Trichuris trichiura	1	0.8

*Tulsky and Lichter (1976), p. 412.
**Pinworm. The most common worm infection in the United States. Generally a benign disease spread by fecal-oral contamination.

Delaware/Maryland/Virginia (Delmarva)

The pediatric charts of patients seen in 1983 by the migrant health clinics of Delmarva Rural Ministries (with headquarters in Dover, Delaware) were reviewed. Results showed that 353 children under six years of age were seen in 706 visits (i.e., an average of two visits per child). Seventeen percent (17% or 120 visits) were diarrhea-related; 30% of all the children under one year of age presented with diarrhea. For children less than two years old, the incidence of diarrhea was 21% for Hispanics, 29% for blacks, and 38% for Haitians. At highest risk of suffering infant diarrhea were Haitian children under one year of age (45%) (Tauxe, 1984).

The Centers for Disease Control (CDC) of the U.S. Public Health Service in Atlanta, Georgia, are planning a collaborative project with five or six eastern migrant health centers to study the prevalence of parasitic infection among migrant farmworker children (Tauxe, 1984). The CDC will examine rectal swab cultures of children with and without diarrhea and will note age, sex, ethnic origin, and attendance at day care centers. Clinicians will note the severity of the diarrhea and whether dehydration occurs as well as any other symptoms. The study is designed to answer the following questions:

- What are the expected rates of diarrheal illness in children in east coast migrant health centers?
- Which groups of children are at highest risk?
- Which strains of enteropathic *Escherichia coli* (EPEC) are causing diarrhea?
- What percentage of diarrhea is caused by EPEC?

Zoonotic Diseases

Zoonotic diseases (zoonoses) are those diseases that are common to both animals and humans. They may be transmitted from animals to humans directly or contracted by humans from the environment, with animals as the source of contamination (Lawhorne, 1976).

Although most migrant and seasonal farmworkers do not directly handle farm animals such as dairy cows or hogs, they are at risk of contracting diseases transmitted via animal feces if exposed animal waste is present in the fields or areas they must enter to reach the worksite, or if they drink or use contaminated water (e.g., containing *Salmonella*). Workers who are forced to live out in the open may also be bitten by wild animals such as skunks or raccoons and contract rabies, a disease which is almost always fatal. In addition, rats and wild animals can spread such diseases as bubonic plague and leptospirosis among humans.

This section deals briefly with three diseases:

- Tetanus
- Leptospirosis
- Coccidiomycosis

(For a more in-depth treatment of zoonoses, see Shapiro and Foster, 1980 and Fischman et al., 1973.)

Tetanus (Lockjaw)

Tetanus is now a comparatively rare disease in developed countries. It is caused by the spore-bearing bacteria *Clostridium tetani*. Soil that has been treated with manure is a prime source of spores, which are highly resistant and can be carried a great distance when blown about in dust.

Tetanus often develops after wounds of various types have occurred, especially those in which dirt or foreign matter has been introduced or where the tissue has been devitalized. Puncture wounds and deep contused wounds and lacerations are more susceptible to tetanus than are superficial abrasions and scratches. Gunshot wounds and third degree burns are particularly implicated (Comstock, 1983).

The tetanus bacteria multiplies chiefly at the site of inoculation, producing a poison or exotoxin that irreversibly attaches to cells in the central nervous system and causes exaggerated motor activity. Tetanus should be suspected in any patient, particularly an agricultural worker or rural resident, who presents with a history of untreated dirty wound exposure and initial complaints of stiffness of the neck and difficulty opening the jaw (Shapiro and Foster, 1980).

Tetanus is a virulent, usually fatal disease, yet it is almost completely preventable by use of periodic immunization.

Leptospirosis

This disease is transmitted by contact with water, moist soil, or vegetation contaminated by urine of infected animals or from direct contact with infected animals. A wide range of animals can be infected: farm and pet animals, including cattle, dogs, horses, and swine; rats and other rodents; and wild animals such as skunks, squirrels, opossums, and even reptiles and frogs (Benenson, 1975).

Clinical manifestations include fever, headache, chills, severe malaise, vomiting, muscular aches and conjunctivitis. Occasionally meningitis or rash may occur. Infrequently jaundice, renal insufficiency, which may lead to kidney failure, or bleeding from the mucous membranes occurs.

Leptospirosis is caused by a spirochete, a type of pathogenic microorganism. It is an occupational hazard to rice workers, sugarcane field workers, farmers, sewer workers, miners, veterinarians, animal husbandry workers, workers in the fishing industry, and military troops. Fatality is low but increases with advancing age and may reach 20% or more in patients who develop jaundice and kidney damage (Benenson, 1975).

Coccidiomycosis (Valley Fever)

This fungal disease is very common in the arid and semiarid areas of the Western hemisphere: in the United States from California to west Texas and in northern Argentina, Venezuela, Mexico, and Central America. *Coccidioides immitis* grows in soil, and infection occurs when dust containing the fungal spores is inhaled.

Symptoms vary from none to those similar to an acute influenzal illness with fever, chills, cough, and pleural pain. The infection may either heal completely, leave fibrosis or calcification of pulmonary lesions, leave a persistent thin-walled cavity, or even, most rarely, progress to the disseminated form of the disease, coccidioidal granuloma, which is comparable to progressive primary tuberculosis.

Progressive primary coccidioidomycosis or coccidioidal granuloma is a highly fatal disease characterized by lung lesions and abscesses throughout the body, especially in subcutaneous tissues, skin, bone, peritoneum, testes, and the central nervous system (Benenson, 1975). Coccidioidomycosis can be detected by use of a skin test with coccidioidin, which is similar to the TB (PPD) skin test.

Skin Infections

Infectious diseases of the skin can be spread by unsanitary conditions at home or work. The lack of adequate bathing and laundering facilities and the absence of handwashing facilities in the fields contribute to the spread of scabies, which is caused by the *Sarcoptes scabiei* mite, cutaneous larva migrans, which is caused by infective larvae of cat and dog hookworm spread most prevalently in the Southeast in sandy soil contaminated with cat and dog feces, impetigo, which is caused by *Staphylococcus aureus*, and ringworm, which is caused by various fungi.

Other Infectious Diseases

A number of serious diseases are spread by discharges from the mouth, nose, throat, or lungs of infected persons. When workers toil close together, when handwashing facilities are not provided, and when more than one worker must share the same drinking cup, the chances of spreading infectious diseases increase dramatically. Transmission can occur via exposure to airborne droplets of sputum from infected individuals as in the case of tuberculosis or by direct contact with pharyngeal secretions or feces of infected persons in the case of poliomyelitis. Measles is transmitted by droplet spread, direct contact with nasal or throat secretions or urine of infected persons, or by objects freshly contaminated with nasal or throat secretions such as a drinking cup. The following diseases can be transmitted, among other ways, via contaminated drinking utensils (Ehlers and Steel, 1965; Salvato, 1958):

- Poliomyelitis
- Tuberculosis
- Diphtheria
- Measles
- Scarlet fever
- Streptococcal sore throat
- Whooping cough
- Chicken pox
- Meningococcal meningitis
- Pneumonia
- Influenza
- Common colds

To avoid spread of these diseases, adequate sanitary conditions must be enforced: disposable cups must be available or each worker have his or her own drinking utensil. For example, in his testimony before OSHA in Washington, D.C. in 1984, Mr. Chuck Stout, Director of the Migrant Health Program, Colorado Department of Health, cited the case of 26 adult male farmworkers from the same lettuce-picking crew, who did not live together, but who contracted strep throat within the same few days. They all had shared the same drinking utensil, and no new cases appeared after disposable paper cups were made available (Stout, 1984).

Although information to precisely pinpoint the incidence of tuberculosis among migrant farmworkers is not available, it is known that higher rates of tuberculosis occur among the population groups that are heavily represented among the migrants. For instance, 12.5% of cases reported in 1984 in the United States occurred among Hispanics. Many migrants enter this country from areas of the world where tuberculosis rates are much higher than in the United States (e.g., Southeast Asia, Latin America, Haiti) (Centers for Disease Control, 1985).

The incidence of tuberculosis in the six major farmworker counties in North Carolina was two to three times higher than the rate in the six poorest counties in the state, where one would expect the highest rates of disease (Hatch et al., 1982). For non-whites in the farmworker counties, the rates were three to seven times higher than the average state rate of 17.4 cases per 100,000. In North Carolina, the Office of the Chief Medical Examiner has been compiling mortality data since 1978 on farmworkers who die in the state. Autopsies have shown that between 20-25% of the farmworkers have some form of tuberculosis — either inactive, healed, or active cases (Hudson, 1984).

Tuberculosis in migrants presents special problems because of the need for long-term or preventive treatment, contact examinations, and because of population mobility, fear of deportation, cost of treatment, etc. (Centers for Disease Control, 1985).

REFERENCES CITED

Andujar, J.J.: The Pathogenic Nonentamebic Amebae (Hartmannella Amebae) in: *Pathology of Protozoal and Helminthic Diseases*, (R.A. Marcial-Rojas, ed.). Huntington, NY: Robert E. Krieger Publishing Company, 1975, pp. 139-144.

Beaver, P.C., Jung, R.C. and Cupp, E.W.: *Clinical Parasitology*, Ninth Edition. Philadelphia: Lea & Febiger, 1984, pp. 124-125.

Benenson, A.S. (ed.): *Control of Communicable Diseases in Man* (12th ed.). Washington, D.C.: American Public Health Association, 1975.

Centaur Associates, Inc.: *Final Report: Industry Profile Phase I Study, Field Sanitation*. September 1983. Entered into the OSHA field sanitation record as Exhibit No. 11-017, Docket No. H-308.

Centers for Disease Control: Intestinal Parasite Surveillance Annual Summary, 1977. September 1978.

Centers for Disease Control: *Tuberculosis and Migrant Farm Workers*. June 1985. Pamphlet available from: National Migrant Referral Project, Inc., 2512 South IH-35, Suite 220, Austin, TX 78704.

Comstock, G.W.: Coccidioidomycosis. Part of Chapter 5, "Miscellaneous Other Unclassified Infections" in *Preventive Medicine and Public Health*, Tenth Edition, (P.E. Sartwell, ed.). New York: Appleton-Century-Crofts, 1973.

Dull, H.B. and Dowdle, W.R.: Diseases Transmitted Chiefly from Person to Person. Chapter 2 in: *Preventive Medicine and Public Health*, Tenth Edition (P.E.

Sartwell, ed.). New York: Appleton-Century-Crofts, 1973.

Edwards, R.E.: Personal communication on January 24, 1984 of results of parasitology survey among migrant farmworkers in eastern North Carolina. Robert E. Edwards, Ph.D., Professor, Department of Parasitology, University of North Carolina School of Public Health, SPH; 201-H, Chapel Hill, NC 27514 (phone: 919-966-1656).

Ehlers, V.M. and Steel, E.W.: *Municipal and Rural Sanitation* (6th ed.). New York: McGraw-Hill Book Company, 1965.

Fischman, H.R., Schiller, E.L., Bang, F.B., et al.: Zoonoses. Chapter 4 in: *Preventive Medicine and Public Health*, Tenth Edition, (P.E. Sartwell, ed.). New York: Appleton-Century-Crofts, 1973.

Hatch, J., Bryant A., Winn, B., et al.: *Hazards of the Harvest: A Report on Farmworkers' Health in North Carolina to the Legislative Study Commission on Migrant Farmworkers*, March 18, 1982. Contact: Farmworker Legal Services of North Carolina, P.O. Box 1229, Raleigh, NC 27602 (phone: 919-821-5869).

Hudson, P.: Personal communication on February 7, 1984 with Page Hudson, M.D., Chief Medical Examiner for the State of North Carolina, Chapel Hill, NC 27514 (phone: 919-966-2253).

Lawhorne, L.: The Health of Farmers. *Iowa Medical Society Journal* 66(10):409-418, 1976.

Myers, W.F.: Testimony by William F. Myers, Ph.D., Associate Professor of Microbiology, University of Maryland School of Medicine, before the U.S. District Court for the District of Columbia, *El Congreso v. Ray Marshall*, December 16, 1980.

Ortiz, J.S.: Composite Summary and Analysis of Hearing Held by the Department of Labor, Occupational Safety and Health Administration on Field Sanitation for Migrant Farm Workers (Docket No. H-308) Held from May 23, 1984 to June 29, 1984. Entered into the OSHA field sanitation record on October 21, 1985.

Ortiz, J.S.: The prevalence of intestinal parasites in Puerto Rican farmworkers in Western Massachusetts. *American Journal of Public Health* 70:1103-1105, 1980.

Richards, F.O., Schantz, P.M., Ruiz-Tiben, E., et al.: Cysticercosis in Los Angeles County. *Journal of the American Medical Association* 254(24):3444-3448, 1985.

Salvato, J.A.: *Environmental Sanitation*. New York: John Wiley & Sons, Inc., 1958.

Shapiro, S. and Foster, D.: *Hazards to Agricultural Workers*. September 1980. Published by Arizona Center for Occupational Safety and Health, 1145 N. Warren Avenue, Tucson, AZ 85724 (phone: 602-626-7900).

Stauffer, J.Q. and Levine, W.L.: Chronic diarrhea related to Endolimax nana: Response to treatment with metronidazole. *American Journal of Digestive Diseases* 19:59-63, 1974.

Stout, C.: Testimony Prepared for Hearings on Proposed Field Sanitation Standards by the Occupational Safety and Health Administration. May 23, 1984. Entered into the OSHA field sanitation record as Exhibit 20, Docket No. H-308.

Tauxe, R.: Presentation on enteric illness at annual Migrant Health Conference sponsored by the National Association of Community Health Centers, Charleston, South Carolina, April 12, 1984.

Tidwell, R.A.: Written comments submitted to the Occupational Safety and Health Administration, May 1984, regarding the proposed field sanitation standard (29 CFR Part 1928). Contact: Medical Director, Clinica Adelante, Inc., P.O. Box 760, El Mirage, AZ 85335 (phone: 602-933-9671).

Tri-County Community Health Center: Prevalence data of parasitic infections among migrant farmworker children and pregnant women, 1983. Entered into the OSHA field sanitation record, Docket No. H-308. For more information, contact: Executive Director, Tri-County Community Health Center, P.O. Box 237, Newton Grove, NC 28366 (phone: 919-567-6194).

Tulsky, K.G. and Lichter, E.A.: Survey of intestinal parasites in children of migrant farmworkers in Rochelle, Illinois. *Health Care Research in Illinois* Volume I, pp. 404-416. The Proceedings of the First Annual Illinois Health Care Research Symposium, November 1976, Rockford, Illinois. Sponsored by the Department of Health Systems Research, Southern Illinois University School of Medicine and the Office for Community Health Research, University of Illinois, Rockford School of Medicine.

U.S. House of Representatives Subcommittee on Agricultural Labor: *Hearings on Typhoid Outbreak in Dade County, Florida*. 93rd Congress, 1st Session, Washington, D.C.: U.S. Government Printing Office, 1974.

Winsberg, G.R., Sonnenschein, E., Dyer, A.R. et al.: Prevalence of intestinal parasites in Latino residents of Chicago. *American Journal of Epidemiology* 102:526-532, 1975.

VIII. Urinary Tract Infections/Kidney Problems

Farmworkers are at least three to five times more likely to contract a urinary tract infection (UTI) than the general population. The lack of toilets and drinking water in the fields contributes significantly to this increased risk.

Chronic urine retention encourages bacterial growth in the urinary tract, stretches and weakens the bladder walls, and increases susceptibility to bladder infection. Chronic UTI may lead to kidney infection or failure, or possibly even bladder cancer. Adequate water intake and regular, frequent elimination are necessary if one is to avoid UTI.

Women in general run a higher risk of UTI because their shorter urethra gives bacteria easier access to the bladder. In addition, maternal urinary tract infections during pregnancy have been associated with increased rates of miscarriages, fetal and neonatal deaths, as well as premature delivery with its attendant risks.

The usual cause of urinary tract infections (UTI) is the growth of gram-negative bacilli — most commonly *Escherichia coli* — at any site in the urinary tract. These bacteria can reach the bladder via the bloodstream, lymphatic system, or urethra and are found routinely in normal healthy intestinal tracts.

There are four general types of UTI: asymptomatic bacteriuria, cystitis, and acute and chronic pyelonephritis. Asymptomatic bacteriuria is a localized infection of the surface of the bladder similar to surface infections of other organ systems such as the upper respiratory tract or the skin. This infection is usually recognized only by the abnormally large amount of bacteria in the urine. Cystitis is an infection of the bladder in which bacteria may penetrate deeper layers of bladder tissue, causing frequent and urgent urination, painful discharge of urine, and, in severe or acute cases, low grade fever. The patient's urine may be bloody, cloudy, or foul-smelling. In acute pyelonephritis, the bacteria in the bladder invade the upper urinary tract and kidneys, usually causing the patient to become ill with chills, fever as high as 104° F, nausea, flank pain, and symptoms of cystitis. Diagnosis is easily made by obtaining a medical history, physical examination, urinalysis, and urine culture (Diokno, 1984). Chronic pyelonephritis is the condition of recurring episodes of acute pyelonephritis (Paterson, 1980). However, often there may be a lack of evidence of infection. Episodes may occur infrequently, and symptoms of pyelonephritis or even cystitis may not appear. Low grade renal deterioration is the result of chronic pyelonephritis (Centaur Associates, Inc., 1983).

Epidemiology

Health surveys among women show an incidence of asymptomatic bacteriuria (bacteria in the urine) of 4% in early adulthood (25 years old). Symptomatic bacteriuria (urinary tract infection), however, occurs considerably less often. The incidence of asymptomatic bacteriuria increases at a rate of about 1% per decade (Diokno, 1984). Stamey (1978) also estimated that some 10-20% of all women will suffer a urinary infection at some time in their lives. In males, excluding the infant male, rates of bacteriuria are negligible except in the older age group. The overall rate of bacteriuria in adult male populations is 0.5% (Kass and Brumfitt, 1975). Women run a higher risk of UTI because their shorter urethra gives bacteria easier access to the bladder.

Urine provides a good culture medium for bacteria. When bacteria is allowed to stay in the urine for prolonged periods of time, as in voluntary retention or in the presence of persistent incomplete emptying of the bladder (residual urine) due to weakness of the bladder muscle (hypotonia), bacterial overgrowth will develop to a point that it can overwhelm the tissue and develop infection (Hinman and Cox, 1966). Consequently, frequent, complete emptying of the bladder can eradicate the bacteria. A normal person should void approximately four to six times per day to avoid overdistention of the bladder (Diokno, 1984).

Adatto et al. (1979), in a study of clinic patients who were college women afflicted with UTI, showed a significant difference in the rate of reinfection between patients who reported following a regimen of regular urination (approximately every two hours) and adequate hydration (at least eight glasses of water a day) and those who did not. Sixty-five percent (65%) of those who reported following the regimen had no UTI (symptomatic or asymptomatic) during the follow-up period of one to two years, and an additional 19% experienced a reduction in the frequency of reinfection. Those who did not follow the regimen continued to have infection rates comparable to their previous pre-interview experience.

Lapides et al. (1968) investigated the problem of recurrent urinary tract infection in women. In a group of 112 women who were evaluated for recurrent UTI, 68% were found to have a bladder capacity larger than normal and/or gave a history of infrequent urination, voiding approximately every 5-10 hours. The reasons given for voluntary retention of urine were lack of toilet facilities, poor access to toilets, filthy toilets, strict working conditions, tight or complicated garments, or mistaken beliefs about voiding habits.

Occurrence of UTI among Farmworkers

Evidence submitted to the OSHA field sanitation record showed migrant farmworkers to have prevalence rates of UTI between 1.3-6.7%, with a mean of 5.5%. In contrast, the prevalence of UTI among the general population is about 1.5% (Ortiz, 1984).

Studies of pregnant women in urban areas have revealed prevalence rates of bacteriuria of 4-6%. Prevalence increases with age and number of pregnancies; some data have shown a somewhat higher rate of bacteriuria in low income populations (Kass, 1970). No such statistics are available on pregnant farmworkers. A review of the medical records of 160 prenatal migrant and seasonal farmworker patients in North Carolina showed that 30% had been diagnosed as having urinary tract infections (Watkins et al., 1985).

Treatment and Prevention

Treatment of urinary tract infections can be divided into immediate and long-term care. The immediate therapy is to control infection and the debilitating symptoms by giving the patient a urinary antibacterial and a urinary anesthetic agent. The conventional therapy lasts 7-10 days (Diokno, 1984), but because migrant farmworkers tend to not follow through with drug therapy, in cases of simple UTI, the single-dose drug treatment may be used.

The long-term goal is to prevent recurrence by identifying and eradicating the causes. In a few cases, a specific anatomic cause can be found, such as a stricture, a stone, etc., which can be removed; however, the majority of these patients also have poor voiding habits that must be changed. Prevention calls for developing the habit of frequent voiding (every three to four hours) during the day and at least once per night. Such a program will help prevent overdistention and hypotonic bladder, precluding ischemia (deficiency of blood to a part of the body due to functional constriction or actual obstruction of a blood vessel) and the overwhelming growth of bacteria that are already in the bladder (Diokno, 1984).

Provision and maintenance of easily accessible toilets with toilet paper and handwashing facilities in the fields are necessary to allow frequent voiding and, thus, prevention of UTI among farmworkers. In addition, adequate supplies of potable drinking water are critically important. Urine is needed to stimulate the stretch receptors of the bladder to warn the person of the need to void. Water is one of the body's important sources of urine, fostering frequent voiding and helping to prevent excessive bacterial multiplication inside the bladder. Even more important, however, is the fact that dehydration is one cause of kidney stones, which also cause further urinary tract infections. Another factor to keep in mind is that many of the drugs used to treat UTI are more effective if the patient is adequately hydrated. Moreover, drug toxicity may become a problem in the dehydrated patient (Newhouse, 1984).

Hazards During Pregnancy

Urinary tract infection poses special dangers during pregnancy. UTI is more prevalent among pregnant women in general because their urine tends to be at a pH conducive to the growth of urinary pathogens, and because the glucose concentration in their urine is higher than normal (Centaur Associates, Inc., 1983).

Maternal urinary tract infections during pregnancy have been associated with increased rates of premature births and fetal and neonatal deaths including stillbirths (Naeye, 1979; Sever et al., 1977; Henderson et al., 1962). The Naeye study found that the combined perinatal mortality rate for eight common placental and fetal disorders in women who had UTI was twice that of non-infected women (42 versus 21 per 1,000 births, respectively). Studies have also shown that toxemia, a risk factor for premature delivery, occurs at significantly higher rates among pregnant women who have bacteriuria compared to those who do not (Kass, 1970).

The incidence of women with asymptomatic bacteriuria in early pregnancy who develop pyelonephritis later in the pregnancy may be as high as 10-12% in a disadvantaged socioeconomic population. The risk of premature birth is higher in women with pyelonephritis who are not treated. In addition, untreated pyelonephritis can result in higher rates of fetal wastage (Bresette, 1984). A follow-up study of women who had been bacteriuric during their pregnancies 10-12 years earlier revealed that 27% were currently bacteriuric, over five times the rate of the control group. In addition, 28% of these bacteriuric women had x-ray evidence of chronic pyelonephritis. Overall, the indications are that approximately 10-15% of bacteriuric pregnant women are destined to have evidence of chronic pyelonephritis 10-12 years afterward (Kass, 1970).

Other Chronic Effects

An infection that progresses from the bladder to the ureters and into the kidneys can become chronic and lead to the destruction of large portions of kidney tissue (e.g., pyelonephritis and hydronephrosis) (Kunin, 1979). Estimates are that between 10-15% of people who must undergo kidney dialysis must do so because of renal failure due to chronic pyelonephritis. Pyelonephritis also accounts for a substantial proportion of individuals who need kidney transplants (Bresette, 1984).

Bladder cancer also has been associated with a history of chronic UTI. Kantor et al. (1984) compared bladder cancer patients to the general population with regard to frequency of urinary tract infections. They found that a history of urinary tract infection doubled the patient's risk of bladder cancer, particularly in individuals who reported having had three or more infections. Individuals with a history of three or more urinary tract infections were at almost five times the risk of developing squamous cell carcinoma of the bladder when compared to individuals with a history of fewer than three urinary tract infections. Such findings have serious implications for farmworker women who have repeated urinary tract infections.

Again, it should be noted that farmworkers who lack adequate potable drinking water during the workday become dehydrated, which ultimately causes kidney stones to develop, and kidney stones are a primary cause of urinary tract infections.

REFERENCES CITED

Adatto K., Doebele K.G., Galland L., et al.: Behavioral Factors and Urinary Tract Infection. *Journal of the American Medical Association* 241(23):2825-2826, 1979.

Bresette, J.: Comments of John Bresette, M.D., Chief of Urology at Columbia Hospital for Women and the Veteran's Administration Hospital, Washington, D.C. to the OSHA field sanitation record, Exhibit 62 of Docket No. H-308, 1984.

Centaur Associates, Inc.: *Final Report: Industry Profile, Phase I Study, Field Sanitation*. September 1983. Entered into the OSHA field sanitation record as Exhibit No. 11-017 of Docket No. H-308.

Diokno, A.C.: Urinary Tract Infection. Testimony presented by Ananias C. Diokno, M.D. (Professor, Department of Surgery (Section of Urology), University of Michigan at Ann Arbor) on May 24, 1984, Washington, D.C. at the OSHA field sanitation hearings. Entered into the OSHA field sanitation record as Exhibit No. 23 of Docket No. H-308.

Henderson, M., Entwisle, G., and Tayback, M.: Bacteriuria and Pregnancy Outcome: Preliminary Findings. *American Journal of Public Health* 52(11):1887-1893, 1962.

Hinman F. and Cox G.: The voiding vesical defense mechanism: the mathematical effect of residual urine, voiding interval and volume on bacteriuria. *Journal of Urology* 91:491-498, 1966.

Kantor, A.F., Hartge, P., Hoover, R.N., et al.: Urinary Tract Infection and Risk of Bladder Cancer. *American Journal of Epidemiology* 119(4):510-515, 1984.

Kass, E.H.: Pregnancy, Pyelonephritis and Prematuring. *Clinical Obstetrics and Gynecology* 13(2):239-254, 1970.

Kass, E.H. and Brumfitt, W.: Infections of the urinary tract. *Proceedings of the Third Symposium on Pyelonephritis* held at the Royal College of Physicians, London, England, July 21-23, 1975.

Kunin, C.M.: *Detection, Prevention and Management of Urinary Tract Infections* (3rd Ed.). Philadelphia: Lea & Febiger, 1979.

Lapides, J., Costello, R.T., Zierdt, D.K., et al.: Primary cause of recurrent urinary tract infection in women. *Journal of Urology* 100:552-555, 1968.

Naeye, R.L.: Causes of the Excessive Rates of Perinatal Mortality and Prematurity in Pregnancies Complicated by Maternal Urinary Tract Infections. *New England Journal of Medicine* 300(15):819-823, 1979.

Newhouse, P.A.: 1983 Incidence of Selected Diagnoses. Migrant and Community Clients. July 2, 1984. Contact: Ms. Lynn Clothier, Executive Director, Indiana Health Center, Inc., 129 E. Market St., Suite 1010, Indianapolis, IN 46204.

Ortiz, J.S.: Composite Summary and Analysis of Hearing Held by the Department of Labor, Occupational Safety and Health Administration on Field Sanitation for Migrant Farm Workers (Docket No. H-308) held from May 23, 1984 to June 29, 1984. Entered into the OSHA field sanitation record on October 21, 1985.

Paterson, P.Y.: Urinary Tract Infections: General Considerations. In: *The Biological and Clinical Basis of Infectious Diseases* (2nd edition): G.P. Youmans, P.Y. Paterson, and H.H. Sommers (eds.). Philadelphia: W.B. Saunders and Company, 1980.

Sever, J.L., Ellenberg, J.H., and Edmonds, D.: Maternal Urinary Tract Infections and Prematurity. In: *The Epidemiology of Prematurity* (D.M. Reed and F.J. Stanley, eds.). Baltimore: Urban & Schwarzenberg, 1977, pp. 193-196.

Stamey, T.A.: Urinary tract infection in women. Chapter 11 in: *Campbell's Urology* (J.H. Harrison et al., eds.). Philadelphia: W.B. Saunders, 1978, pp. 451-479.

Watkins, E.L., Peoples, M.D., and Gates, C.: Health and Social Needs of Women Farmworkers Receiving Maternity Care at a Migrant Health Center. *Migration Today* XIII (2):39-42, 1985.

IX. Heat Stress

Agricultural workers are at highest risk of developing a heat disorder on the job as compared to all other workers, including miners and construction workers. Heat-related problems range from prickly heat rash to fatal heat stroke. Some of the risk factors for developing heat-related illness include excessive fatigue, pregnancy, diarrhea, obesity, poor physical condition, diabetes, and alcoholism.

Nationwide, at least one-fifth of labor-intensive farmwork is performed without the benefit of employer-provided drinking water. Agricultural employers should be required by law to provide adequate amounts of cool and clean drinking to avoid worker dehydration and development of a heat disorder. Frequent, brief rest periods also are necessary on hot days. Education for farmworkers, crewleaders, and other supervisors on the prevention, recognition, and first-aid treatment of heat-related illness is needed to lower farmworkers' heat-related morbidity and mortality.

Heat stress refers to adverse effects on the body due to physical exertion in hot environments. Farmworkers are especially susceptible to heat stress because they perform strenuous outdoor labor for long periods of time in hot and/or humid climates.

Under such working conditions, farmworkers may lose one to three gallons of fluid per day by sweating. If they do not replace the amount of water lost each day in perspiration, they risk becoming dehydrated. When the body's fluid and salt balance is not maintained, a heat disorder may result. Dehydration leads to increased body temperature and heart rate, which lead to circulatory shock (Guyton, 1976), as well as liver, kidney, heart, and brain damage (Guyton, 1977). Weakness, lassitude, apparent laziness, visual disturbances, headaches, nausea, vomiting, muscle cramps, breathlessness, palpitations, convulsions, delirium, and coma all are symptoms associated with the lack of drinking water (Shibolet et al., 1967).

Simply quenching one's thirst does not provide sufficient water replacement to maintain the body's fluid balance during heat exposure. If workers sweat profusely but do not systematically replace their fluid and salt loss, most of them will end each workday dehydrated.

Dehydration can best be reduced by frequently drinking small amounts of water rather than by imbibing large amounts more infrequently. The National Institute for Occupational Safety and Health (NIOSH) recommends that workers be encouraged to drink cool (palatable) water at least once per hour (preferably every 15 to 20 minutes), and that the water supply be located as close as possible to the worksite, but never farther than 200 feet away (NIOSH, 1976).

Water is the best liquid for combating dehydration, and agricultural employers should be made to supply adequate quantities of potable water for farmworkers. A national survey estimates that 21% of labor-intensive farmwork (i.e., harvesting, weeding, thinning, and related operations in fruit, vegetable, nut, tobacco, sugar cane, sugar beet, hops and cotton crops), as measured in person-years, is performed without drinking water being provided by the employer (Centaur Associates, Inc., 1984).

In fields where drinking water is inadequate or unavailable, farmworkers may bring some water in their own containers or often buy cans of soft drinks or beer from the crewleader. Soft drinks are high in sugar, which, over time, helps dehydrate the body. Alcohol also should be avoided since it not only adds to the physiological stress caused by heat, but also stimulates the kidneys to eliminate body fluid over and above what is lost through sweating, thus enhancing the dehydrating effects of heat.

Risk Factors

The following factors increase a worker's risk of developing heat-related illness:

- Obesity
- Fatigue
- Lack of acclimatization
- Diarrhea
- Alcoholism
- Age extremes (very young and very old)
- Sunburn
- Previous heat stroke
- Chronic diseases (e.g., diabetes, lupus)
- Drugs (e.g., diuretics, antidepressants)
- Pregnancy
- Acute febrile illnesses
- Poor physical condition, including poor nutrition
- Reaction to immunizations
- Recent ingestion of food
- Improper clothing

One of the most important concepts in the prevention of heat injuries in athletes and workers is acclimatization, or the gradual development of a tolerance to a climate hotter than that to which the person had been accustomed. This is accomplished by starting work at a low level and daily increasing the workload, taking frequent breaks, drinking sufficient amounts of water, and wearing proper clothing. Through this process, a number of physiological adaptations occur to augment the person's resistance to heat stress (e.g., increased maximal cardiac output, increased cutaneous blood flow, increased capacity for heat dissipation) (Howard, 1984).

The list of risk factors for heat-related illness is of special concern in farmworkers because:

1. Their workday is long and spans the hottest time of the day in the hottest season.
2. The work usually requires moderate to heavy physical exertion.
3. The general health of the migrant farmworker population is usually below average.

(4) Cool clean water may not be available in sufficient quantities.

(5) Frequent rest periods are discouraged even on dangerously hot days.

(6) Work may be carried out in poorly ventilated buildings such as packing sheds where the temperature is even higher than outdoor temperatures.

(7) Living quarters are usually not air conditioned, possibly causing sleep deprivation and fatigue (Howard, 1984).

(8) Farmworkers and their families run a higher risk of developing sanitation-related diseases, including gastrointestinal and parasitic conditions that can cause diarrhea, fever, and vomiting, and lead to dehydration.

(9) Farmworkers are exposed to pesticide residues on the crops and are also at risk of being poisoned by direct spray or drift. Recent research has indicated that mild water deprivation in experimental animals may significantly increase cholinesterase inhibition on exposure to organophosphates (Baetjer, 1983). The implication for the farmworker without sufficient drinking water is increased risk of acute pesticide poisoning. In addition, in hot, sunny, dry weather the degradation products of some organophosphates are even more toxic than the original chemical (e.g., parathion degrades to the more toxic substance paraoxon, malathion to malaoxon).

(10) Certain substances such as coal tar and cresols create exceptional photosensitivity of the skin. Even a short exposure in the late afternoon when the sun is low is likely to produce severe sunburn (Olishifski and McElroy, 1971).

(11) Agriculture has the second highest rate of accidental deaths (52/100,000 workers) (Centers for Disease Control, 1984), and there is a definite correlation between hot weather and frequency of accidents (NIOSH, 1972). Fainting due to heat stress may lead to falls from ladders among orchard workers or injury or death from accidents involving farm machinery.

(12) Medical care for farmworkers is often not readily available or accessible.

(13) The less severe heat disorders may not be diagnosed or treated correctly since the symptoms can be confused with influenza or even mild pesticide poisoning.

(14) Farmworkers have little information on the dangers of heat-related injuries and how to avoid them.

Heat Disorders And Their Treatment

Dehydration can lead to three major types of heat disorders: heat cramps, heat exhaustion, and heat stroke.

Heat Cramps

Heat cramps are the least serious of the heat disorders and can usually be treated by the sufferer. People who do a lot of physical work in the heat or who exercise and sweat a lot on a very hot day may experience heat cramps at the end of the day, the symptoms of which are listed below:

- Pale, cool, moist skin
- Weakness and nausea (no confusion)
- Fast pulse (sometimes)
- Heavy sweating
- Tingling in arms and legs
- Dull pain in abdomen
- Painful muscle cramps in arms, legs, or stomach

Heat cramps occur most commonly in those individuals who are fit and acclimatized and are characterized by severe, brief cramps in those skeletal muscles that have been subjected to intensive work, usually the calf muscles and occasionally the muscles of the anterior abdominal wall. They are seen in those who sweat profusely and who replace this fluid loss with water, a hypotonic solution. The resulting serum sodium deficiency is thought to be the underlying cause of this problem, and its replacement (e.g., by eating salty crackers and drinking water or drinking a mixture of one-half tomato juice and one-half water) usually brings prompt relief. Potassium loss may also play a role in heat cramps; liberal consumption of fresh fruits will prevent depletion of potassium in the body (Howard, 1984).

Heat Exhaustion

It takes more time to develop heat exhaustion than it does to contract other heat-related illnesses. Heat exhaustion results from water and salt loss due to sweating in the heat. Symptoms of heat exhaustion include:

- Weakness
- Dizziness
- Giddiness
- Headache
- Visual disturbances
- Nausea
- Vomiting
- Diarrhea
- Muscle cramps
- Normal or below-normal temperature
- Rapid, weak pulse
- Rapid breathing

In most cases, the person affected remains conscious and can help him- or herself. Heat exhaustion can be prevented by daily intake of enough liquids to replace the amount of water lost through perspiration (U.S. Department of Labor and U.S. Department of Health and Human Services, 1980).

Heat Stroke

Heat stroke, the most severe of the heat disorders, occurs when the body's heat-regulating mechanism goes awry, and the body's core temperature rises to life-threatening levels. Mortality rates ranging from 25-75% have been reported (NIOSH, 1972).

Symptoms of heat stroke include:

- Hot, dry skin (red, mottled or cyanotic, i.e, bluish from lack of oxygen)
- Elevated rectal temperature (often 106°F or higher and rising)
- Headache
- Dizziness
- Brain disorders: mental confusion, delirium, loss of consciousness, convulsions, coma (NIOSH, 1972).

Heat stroke *always* constitutes a medical emergency. The immediate objective is to rapidly cool the person. Victims of heat stroke may die within a few hours or expire later from complications such as acute kidney failure. A number of persons die several weeks after a heat stroke episode, usually of a heart attack, heart failure, liver or kidney failure, bleeding disorders, pneumonia, or a complicating bacterial infection of the blood (Wintrobe et al., 1977; NIOSH, 1972). These complications, as well as the permanent brain injury that is a frequent sequela, are in part consequences of prolonged and uncontrolled hyperthermia (extremely high fever) and in part the result of tissue hypoxia (lack of oxygen) that occurs when shock sets in. Early recognition and treatment of heat stroke can prevent death as well as permanent brain damage (NIOSH, 1972).

Extent Of The Problem

A comparison of workers' compensation claims by industry using 1979 data from the Bureau of Labor Statistics Supplementary Data System showed that the highest incidence of compensation claims for heat disorders occurred among farm laborers. Agriculture led all other industries, with an incidence rate of 9.2 claims per 100,000 employees, followed by construction (6.4) and mining (5.0) (Jensen, 1983). Gangarosa (1984) used Jensen's data to compare the incidence among farmworkers to that among construction workers and miners, two other occupations at high risk for heat-related illness. Chi-square analysis showed that farmworkers run a significantly greater risk for heat disorders compared to these other two groups. Odds ratios showed that farmworkers were at 1.5 times the risk of heat disorders compared to construction workers and at 1.8 times the risk compared to miners.

Ortiz (1984) examined 1979 data from the California Department of Industrial Relations regarding reported occupational heat-related problems. The incidence of these problems was 11.06 per 100,000 agricultural workers (37/374,470) compared to a rate of 2.69 per 100,000 workers (253/9,392,435) in all other occupations: Agricultural workers are over four times more likely to suffer a heat disorder than are nonagricultural workers.

The full extent of this problem is not known, since most cases of heat exhaustion and other types of heat stress are relieved by getting out of the sun (and preferably out of the heat), lying down, and drinking water. In addition, death from heat stroke may be recorded as a heart attack (Centaur Associates, Inc., 1983).

Some documentation does, however, exist; for example, five cases of heat stroke among farmworkers — three of them fatal — were entered into the OSHA field sanitation record (Ortiz, 1984). The three deaths occurred in healthy males aged 18, 22, and 32. These needless deaths highlight the tragic consequences of this preventable work hazard.

REFERENCES CITED

Baetjer, A.M.: Water deprivation and food restriction on toxicity of parathion and paraoxon. *Archives of Environmental Health* 38(3):168-171, 1983.

Centaur Associates, Inc.: *Final Report: Baseline Analysis and Economic Impacts of Proposed Field Sanitation Standard.* Prepared for the Occupational Safety and Health Administration. April 1984. Exhibit 11-017 of OSHA Docket No. H-308.

Centaur Associates, Inc.: *Final Report: Industry Profile, Phase I Study, Field Sanitation.* Prepared for the Occupational Safety and Health Administration. September 1983. Exhibit 11-017 of OSHA Docket No. H-308.

Centers for Disease Control: Leading Work-Related Diseases and Injuries - United States. *Morbidity and Mortality Weekly Report* 33(16):213-215, April 27, 1984.

Gangarosa, E.J.: Epidemiologic Analysis of Data Presented in Evidence in the Rulemaking Record (Docket No. H-308) in Connection with Field Sanitation Proposal (29 DFP 1928.110). September 4, 1984. Entered into the OSHA record on October 21, 1985. (Eugene J. Gangarosa, M.D., M.S. is Professor and Director of the MPH program at Emory University School of Medicine, Atlanta.)

Guyton, A.C.: *Basic Human Physiology: Normal Function and Mechanisms of Disease.* Philadelphia: W.B. Saunders Company, 1977.

Guyton, A.C.: *Textbook of Medical Physiology* (5th edition). Philadelphia: W.B. Saunders Company, 1976.

Howard, W.H.B.: Heat-related Illness. Testimony presented at the OSHA field sanitation hearing, Washington, D.C., May 23, 1984 by William H.B. Howard, M.D. (Sports Medicine Clinic, Union Memorial Hospital, 3300 N. Calvert Street, Baltimore, MD 21218, phone: 301-235-2253). Part of OSHA Docket No. H-308, Exhibit No. 24.

Jensen, R.C.: Workers' Compensation Claims Relating to Heat and Cold Exposure. *Professional Safety.* September 1983, pp. 19-24.

National Center for Appropriate Technology: *Hyperthermia* (brochure), 1981. Address: NCAT, Box 3838, Butte, Montana 59702.

National Institute for Occupational Safety and Health (NIOSH): *Standards for Occupational Exposures to Hot Environments: Proceedings of a Symposium Held in Pittsburgh, Pennsylvania on February 27-28, 1973.* Washington, D.C.: U.S. Department of Health, Education and Welfare, January 1976.

National Institute for Occupational Safety and Health (NIOSH): *Criteria for a Recommended Standard — Occupational Exposure to Hot Environments*, PB 210 794, 1972.

Olishifski, J.B. and McElroy, F.E.: *Fundamentals of Industrial Hygiene.* Chicago: National Safety Council, 1971.

Ortiz, J.S.: Composite Summary and Analysis of Hearing Held by the Department of Labor, Occupational Safety and Health Administration on Field Sanitation for Migrant Farm Workers (Docket No. H-308) Held from May 23, 1984 to June 29, 1984. Entered into the OSHA record on October 21, 1985. (Jesse S. Ortiz, Dr.P.H., is Associate Professor of Environmental Health, School of Health Sciences, University of Massachusetts at Amherst.)

Shibolet, S., Coll, R., et al: Heat Stroke: Its Clinical Picture and Mechanism in 36 Cases. *Quarterly Journal of Medicine* (New Series) 36:525-548, 1967.

U.S. Department of Labor and U.S. Department of Health and Human Services: *Hot Environments.* Job Health Hazards Series. DHHS (NIOSH) Publication No. 80-132. Washington, D.C.: U.S. Government Printing Office, July 1980.

Wintrobe, M.D., Thorn, G.W., et al. (eds.): *Harrison's Principles of Internal Medicine* (8th ed.). New York: Mc-Graw Hill Book Company, 1977.

X. Pesticide-Related Illness

Pesticide exposure of farmworkers may result in acute systemic poisoning or skin or eye problems such as rashes, inflammation, or corneal ulceration. Chronic health problems may include chronic dermatitis, fatigue, headaches, sleep disturbances, anxiety, and disturbances of concentration and memory as well as cancer, birth defects, sterility, blood disorders, and abnormalities in liver and kidney function.

Full knowledge of the extent of acute and chronic pesticide poisoning among migrant and seasonal farmworkers is hampered by the lack of physician training in recognition and treatment of these problems, the absence of information among farmworkers about their workplace exposures, their reluctance to report poisonings, and the lack of a national reporting system to tabulate such poisonings. Additional research is necessary if we are to understand the full effects of chronic pesticide exposure on farmworkers' health.

Pesticide Usage in the United States

Pesticide is a generic term that covers a wide range of compounds used in pest control: insecticides (arthropods), fungicides (smut, blight, mildew, etc.), rodenticides (rats, gophers, rabbits, etc.), herbicides (weeds), acaracides (mites), algicides (algae in swamps, ponds, marshes, etc.), piscicides (fish), avicides (birds), molluscides (slugs, snails), nematocides (worms), and fumigants. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947 calls pesticides "economic poisons" and defines them as "any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any insects, rodents, nematodes, fungi, or weeds or any other form of life declared to be pests...; and any substance or mixture of substances intended for use as a plant regulator, defoliant, or dessicant" (Moses, 1983).

Each year the United States uses about one billion pounds of pesticide domestically and manufactures at least 800 million more pounds for export. Currently in this country, more than 1,500 active pesticide ingredients are formulated to make more than 45,000 registered products (Coye, 1985).

Until the early 1970's, the major pesticides in use were the organochlorine compounds, i.e., DDT and its analogues such as lindane, chlordane, aldrin, dieldrin, heptachlor, endrin, and toxaphene. These compounds were widely used because they were inexpensive, effective, and persistent in the environment. Their slow rate of degradation, however, resulted in environmental contamination, bioaccumulation, and their biomagnification in the food chain, resulting in toxic effects on nontarget species, especially birds and fish, as was documented in Rachel Carson's famous book *Silent Spring*. Because of these hazards as well as concern about possible adverse effects on humans, most of the major organochlorines have either been banned or severely restricted for use in the United States.

To replace the organochlorines, use of organophosphate and carbamate compounds dramatically increased. Having evolved from nerve gas developed by the Germans, many organophosphates are readily metabolized and do not persist in the environment; however, they are much more acutely toxic than the chlorinated hydrocarbons (organochlorines). As a result, organophosphates have caused many cases of poisoning and death (Moses, 1983).

A growing number of other chemicals such as the pyrethroids and herbicides also have replaced the organochlorines. (For a summary of agricultural pesticides, see Table 39.) The rate of herbicide use doubled between 1966 and 1980 and now accounts for two-thirds of the total poundage (by active ingredient) of all pesticides used in the United States. In the same time period, insecticide use decreased by half, and fungicide use also decreased substantially (Coye, 1985).

Farmworker Exposure to Pesticides

Labor-intensive crops are also those that receive heavy pesticide application. Of the one billion pounds of pesticides used annually in agriculture in the United States, 800 million pounds are applied to approximately 20% of the total crop acreage; most of these crops involve use of field labor on a seasonal basis. Furthermore, more than 50% of the farmworkers are hired for harvesting operations, which involve contact with foliage during periods of high pesticide application; of the 27% who work in the cultivation of crops, more than one-third work in cotton, a crop that is heavily sprayed with pesticides. In addition, more than 50% of farmworkers who labor on farms that employ more than 10 workers are found in just two states, California and Florida, and 65% are employed in the production of vegetables, fruits, nuts, tobacco, or sugar (Coye, 1985).

Pesticides are absorbed into the human body through the skin (dermal), via the lungs (inhalation), and by mouth (ingestion). Field laborers are exposed to pesticides in a variety of ways:

(1) Direct spraying of farmworkers in a field through aerial or ground application;
(2) By drift, for example, pesticides that are sprayed on one field are carried by the wind to adjacent fields where workers live and work;
(3) Coming in contact with pesticide residues on plant leaves (e.g., via exposed hands, arms, face, and neck);
(4) Eating in the fields using pesticide-contaminated hands;
(5) Eating the fruits or vegetables that are being harvested without washing them to remove pesticide residues;
(6) When cups are not available, drinking water out of hollowed-out cucumbers, bell peppers, apples, etc., which have been treated with pesticides;

(7) Smoking without washing hands to remove pesticide residues;
(8) Drinking, bathing, or cooking with water contaminated by pesticide residues (e.g., water from irrigation ditches);
(9) Contaminating the genital area after elimination due to inability to wash hands (no clean water and soap available);
(10) Using pesticide-contaminated leaves or twigs in the field as a substitute for toilet paper.

Another factor to consider when measuring the extent of farmworkers' pesticide exposure is the proximity of their housing to the fields; for example, a labor camp may regularly be contaminated by pesticide drift from adjacent fields as they are sprayed. Exposure is even greater for those workers who are without housing of any kind, who actually live in the orchards where they pick. Furthermore, exposure of family members who are not even involved in farmwork also can occur via contact with contaminated workclothes that are worn home and may be washed with the rest of the family's clothing.

Research in the past decade has shown that as much as 98-99% of field worker exposure to pesticide residues is dermal (Coye, 1984). Availability of field toilets, handwashing facilities, and potable water would help reduce the extent of farmworker exposure to pesticides. Not only are handwashing facilities crucial for first aid use in emergencies such as spraying accidents, but routine handwashing would reduce absorption caused by using pesticide-contaminated hands while eating, smoking, and after urination and defecation.

Data on the extent of pesticide exposure to farmworkers include surveys of the workers themselves, studies of dislodgment of residues from foliage (even after EPA reentry intervals have elapsed), and studies of cholinesterase inhibition (an enzyme found in the blood) as a biological index of a worker's exposure to organophosphate or carbamate pesticides.

A survey of 469 farmworkers in southern Florida (Florida Rural Legal Services, Inc., 1980) found that 48.5% (228) of the respondents reported having been directly sprayed with agricultural chemicals at least once while they worked. More than half of the farmworkers in the sample had experienced one or more of the symptoms of pesticide poisoning during 1979, and 126 farmworkers (27%) became ill enough to seek medical help. In 29 of these cases, acute pesticide poisoning was clinically confirmed.

Barger and Reza (1983) conducted a random sample survey of 3,000 married male Mexican-American farmworkers working on the tomato crop in Indiana, Ohio, and Michigan during the 1983 season. Personal interviews were conducted to collect demographic, work history, and health data, among other information. Farmworkers reported having been sprayed or otherwise exposed to pesticides an average of seven times per year, and 21% of the respondents reported ten or more exposures. The range in the number of pesticide-exposure occurrences was 0-40 incidents.

Farmworker reentry poisonings have been a major problem in California. The California Department of Food and Agriculture (CDFA) has conducted numerous field studies of pesticide foliar residue dislodgment (e.g., Richards et al., 1978; Kahn, 1980; Spear et al., 1977). These studies have shown that the reentry intervals (i.e., the time that must elapse between pesticide application and safe entry by workers into the treated area) established by the U.S. Environmental Protection Agency do not provide adequate protection for California farmworkers (see Table 38 and Appendix II). Even after approved EPA reentry times had elapsed, pesticide residue levels exceeded the levels determined to be safe by the California Department of Food and Agriculture.

TABLE 38
EPA PESTICIDE REENTRY INTERVALS*

Chemical (Trade Name)	*Waiting Period (Days)*	*Main Crops Used On*
Azinphosmethyl (Guthion)	1	Fruits, nuts, melons, ornamental shrubs, shade trees
Carbofuran (Furadan)	1#	Grains, tobacco, peanuts, sugarcane, potatoes, grapes, sunflowers
Carbophenothion (Trithion)	2	Fruits, nuts, cotton (also cattle)
Chlorpyrifos	1**	Corn, fruits, nuts, vegetables, cotton
Demeton (Systox)	2	Most fruits, nuts and vegetables
Dicrotophos (Bidrin)	2	Cotton, coffee, soybeans
Endrin	2	Cotton and orchard crops
EPN	1	Corn, rice, cotton, grapes
Ethion	1	Cotton, most vegetables
Fosetyl (Aliette)	7§	Ornamental shrubs, pineapple, hops
Mevinphos (Phosdrin)	2-4¶	Vegetables, fruits, field crops
Monocrotophos (Azodrin)	2	Cotton, tobacco, sugarcane, peanuts, potatoes
Oxydemeton-methyl (Metasystox-R)	2	Flowers, ornamental shrubs, some vegetables
Parathion-ethyl (Parathion)	2	Wide range of uses, including vegetables of all kinds, especially corn and potatoes, and tobacco
Parathion-methyl (Methyl parathion)	2	Same as above, and cotton
Phosalone (Zolone)	1	Apples, cherries, almonds, grapes, artichokes, other fruits and nuts
Propargite (Omite)	7***	Fruits, nuts, ornamentals, cotton, corn, grapes

*EPA *Code of Federal Regulations Title 40, Part 170 - Worker Protection Standards for Agricultural Pesticides.*
Table adapted from chart which appears in "Pesticides and You: A Guide for Farmworkers, Small Farmers and Rural Communities." Published by Rural America, 1302 18th Street, N.W., Washington, D.C. 20036 (phone: 202-659-2800), 1980; a table entitled "List of Pesticides Having Reentry Intervals" prepared by James D. Adams, Office of Pesticide Programs, U.S. Environmental Protection Agency, October 31, 1985 (see Appendix II); and the *1986 Farm Chemicals Handbook.*

#14 days on seed and sweet corn.

**4 days on citrus, grapes, and peaches.

§Hops only.

¶Proposed but not yet implemented.

***Grapes only.

Accordingly, California has adopted longer reentry intervals for a greater number of pesticides than has the federal government. The reentry intervals for a specific pesticide also vary according to the crop being treated. For example, in California, the reentry interval for guthion used on citrus is 30 days and 21 days for grapes; for peaches, nectarines, and apples it is 14 days. In contrast, the federal reentry time for this pesticide is 24 hours. (See Appendix II for a comparison of federal, California, and Texas reentry intervals and for an EPA list of current interim reentry intervals for pesticides going through the reregistration process or special review.) Unlike California and Texas, most of the states have adopted the EPA reentry intervals without more stringent modifications.

When reentry intervals are not enforced or when weather conditions retard the pesticide degradation process, farmworkers are at increased risk of pesticide residue exposure and potential poisoning.

Various studies have examined differences in levels of the enzyme cholinesterase in the blood to measure the extent of an individual's exposure to organophosphate and carbamate pesticides. Spigiel et al. (1981) observed significant reductions in serum cholinesterase activity in 30% of their study population (98 Nebraska farmers and commercial applicators) after occupational use of cholinesterase-inhibiting insecticides. Although symptoms of mild organophosphate poisoning were noted by 22% of the study participants, in all cases these symptoms were ignored, and medical care was not sought. Brown et al. (1978) also noted a statistically significant depression in cholinesterase level during the months of greatest organophosphate use among their study subjects, Canadian vegetable farmers and packing house workers, compared to the control group. However, there were no clinical cases of pesticide poisoning observed.

Quinones et al. (1976) compared the organophosphate pesticide exposure of 57 Puerto Rican migrant farmworkers and 35 non-farmworkers in southern New Jersey. Blood tests were done to determine plasma cholinesterase levels, and medical histories were taken to discover clinical signs and symptoms of organophosphate exposure. Significantly depressed cholinesterase levels were found in the farmworkers, with 10.5% of them having values below the lower limit of normal. Nonetheless, there was no significant relationship between frequently reported symptoms of the farmworkers and depressed cholinesterase levels. In another study, Wicker et al. demonstrated inhibition of both plasma and red blood cell cholinesterase among sweet corn and peach pickers (1979a) and cottonfield workers (1979b) in North Carolina.

Measurement of cholinesterase levels in 370 Puerto Rican pesticide applicators revealed that three percent (3%) of the applicators had below normal cholinesterase levels, and differences among geographic regions were significant (Chiriboga et al., 1985a). A study of 87 Puerto Rican migrant farmworkers showed that seven percent (7%) of them had below normal cholinesterase levels 30-45 days after returning to Puerto Rico. More than half of them had been engaged in farm labor in New Jersey (Chiriboga et al., 1985b).

The Pesticide Hazard Assessment Project, funded by the U.S. Environmental Protection Agency and based in San Benito, Texas, has conducted various pesticide exposure studies, the results of which are not yet published. The purpose of one study of 600 farmworkers was to assess the amount of worker exposure to pesticides sprayed on fruit and vegetable crops. Farmworkers wore air samplers to monitor the amount of pesticide residues being inhaled, and patches of clothing were tested for amounts of pesticide present. Urine samples were collected to determine the level of pesticide metabolites. In addition, leaf samples were analyzed to monitor the rate of pesticide degradation.

In another study by this group, data were recorded and analyzed on the level of pesticide residues in the air in migrant farmworker households located downwind of cotton fields in Texas; the level of pesticide metabolites in the urine of those residents was also checked. (Cotton is heavily treated with various organophosphates.) Residential exposure levels were to be compared with the levels of farmworkers whose exposure was occupationally related (Guillen, 1984).

Results of a two-year prospective epidemiological study of over 1,000 pregnant Hispanic women who were seen at two migrant health centers in California are currently being analyzed. The objective of the project is to study the relationship between the level of occupational pesticide exposure and other field work conditions (e.g., working in the heat, working standing up during the third trimester) and birth outcome (Coye and Fenster, 1984).

What is already known about the health effects caused by pesticide exposure? The majority of the data has been collected on stable occupational populations at the highest risk of exposure to high concentrations of pesticides (i.e., pesticide formulators, manufacturers, mixers, loaders, and applicators) rather than on the migrant farmworker population. In addition, most data have focused on the acute effects of pesticide exposure rather than on the long-term sequelae. Both acute and chronic effects will be discussed below.

Acute Pesticide Poisoning

The potential for a specific pesticide to cause injury depends on various factors:

(1) The inherent toxicity of the active ingredient(s)
(2) The dose and/or concentration of the pesticide
(3) Physical and chemical properties (e.g., some pesticides degrade to more highly toxic substances in hot, dry weather such as parathion to paraoxon)
(4) The route of absorption of the chemical (by ingestion, which usually causes the most severe effects, inhalation, or skin absorption, or by a combination of these three routes)
(5) Duration of exposure
(6) The susceptibility of the victim. For example, children are more susceptible to acute poisoning: they weigh less than adults and thus it takes a lesser amount of pesticide to cause poisoning; they also have more rapid metabolism. Dehydration, poor

TABLE 39
SUMMARY OF AGRICULTURAL PESTICIDES*

Pesticide Class	*Toxicology*	*Acute Signs and Symptoms*	*Laboratory Confirmation*
1. Organophosphate cholinesterase-inhibiting pesticides	Poisons insects and mammals primarily by phosphorylation of the acetylcholinesterase enzyme at the nerve endings	Headache, dizziness, weakness, incoordination; muscle twitching, tremor, nausea, abdominal cramps, diarrhea, and sweating	Depressions of plasma pseudocholinesterase and/or RBC acetycholinesterase enzyme activities are the most satisfactory and generally available biochemical indices of excessive organophosphate absorption.
2. Carbamate cholinesterase-inhibiting pesticides	Causes reversible carbamylation of acetylcholinesterase enzyme, allowing accumulation of acetylcholine at cholinergic neuroeffector junctions (muscarinic effects), and at skeletal muscle myoneural junctions and in autonomic ganglia (nicotinic effects)	Diarrhea, nausea, vomiting, abdominal pain, profuse sweating, salivation, and blurred vision.	Depressions of plasma and/or RBC cholinesterase activities may be observed following absorption of extraordinary amounts of carbamate insecticides. Enzyme activities commonly revert to normal within a few minutes or hours and are not a reliable detector of carbamate poisoning.
3. Solid organochlorine pesticides	In adequate dosage, they interfere with axonic transmission of nerve impulses and, therefore, disrupt the function of the nervous system.	Apprehension, excitability, dizziness, headache, disorientation, weakness, paresthesiae, and convulsions.	Pesticide and/or metabolites can usually be identified in blood and urine by gas-liquid chromatographic examination of samples taken within 72 hours of poisoning.
4. Pentachlorophenol (PCP)	Irritates the skin, eyes, and upper respiratory mucous membranes. It is toxic to the liver, kidney, and central nervous system.	Irritation of nose, throat, eyes, and skin. Dermatitis, profuse sweating, headache, weakness, and nausea.	PCP can be measured in blood, urine, and adipose tissue by gas-liquid chromatography.
5. Nitrophenolic and nitrocresolic herbicides	They are toxic to the liver, kidney, and nervous system. The basic mechanism of toxicity is a stimulation of oxidative metabolism in cell mitochondria, by interference with normal coupling of carbohydrate oxidation to phosphorylation (ADP to ATP).	Yellow staining of skin, profuse sweating, headache, thirst, malaise, and lassitude.	Unmetabolized nitrophenols and nitrocresols can be identified spectrophotometrically, or by gas-liquid chromatography, in the serum and urine.
6. Chlorophenoxy compounds	Some of the chlorophenoxy acids, salts, and esters are moderately irritating to skin, eyes, and the respiratory and gastrointestinal linings. There are some reports of peripheral neuropathy following minor dermal exposure to 2,4-D.	Irritating to skin. When ingested, irritation of mouth, throat and GI tract.	Gas-liquid chromatographic analysis of blood and urine.
7. Paraquat and diquat	Injure the epithelial tissues; skin, nails, cornea, liver, kidney, and linings of the GI and respiratory tracts.	Irritating to skin, eye, and upper respiratory tract. Ingestion causes pain, nausea, vomiting, and diarrhea.	Dipyridyl analysis of blood and urine.

TABLE 39 (continued)

Pesticide Class	*Toxicology*	*Acute Signs and Symptoms*	*Laboratory Confirmation*
8. Dithiocarbamates and Thiocarbamates	Various, depending on specific compounds. In general, mammalian toxicity is low.	Various, depending on specific substance.	Various, depending on specific substance. Rapid metabolization makes detection in blood difficult.
9. Pyrethrum, pyrethrins, pyrethroids, and piperonyl butoxide.	Generally low toxicity for mammals.	Runny nose, wheezing.	Not useful to test because of rapid metabolism of the esters.
10. Arsenical pesticides	Various, depending on specific substance. Once absorbed into the blood after ingestion, there is toxic damage to the liver, kidneys, brain, bone marrow, and peripheral nerves.	Cholic, burning abdominal pain, vomiting, watery or bloody diarrhea from ingestion of solid arsenical poisons.	Measurement of 24-hour urinary excretion of arsenic.

*Adapted from Morgan (1982). Appeared in study entitled *Final Report: Industry Profile, Phase I Study, Field Sanitation* prepared by Centaur Associates, Inc., 1120 Connecticut Avenue, N.W., Washington, D.C. 20036 (phone: 202-296-4100) for the Occupational Safety and Health Administration, U.S. Department of Labor, September 9, 1983. Entered into the OSHA field sanitation record as Exhibit 11-107, Docket No. H-308.

nutrition, pregnancy, advancing age, and pre-existing medical conditions such as hypersensitivity to chemicals or respiratory diseases such as asthma also may predispose a worker to acute poisoning.

Table 39 outlines ten classes of pesticides, their mode of action (toxicology), acute signs and symptoms of poisoning, and the appropriate laboratory procedures to confirm poisoning.

The organophosphates and carbamates inhibit the action of cholinesterase, the enzyme necessary to break down the neurotransmitter acetylcholine once it is released from nerve endings. These pesticides combine with the enzyme, thereby allowing acetylcholine to accumulate in the nerve synapses and cause constant firing of nerve impulses. This leads to overstimulation of nerve fibers regulating vital organs of the body (manifested by increased gastric secretions, salivation, tearing, blurred vision, diarrhea, difficulty breathing, slowed heart rate); skeletal nerve fibers (causing twitching and tingling of the extremities, weakness, paralysis); and the central nervous system (which produces anxiety, restlessness, headache, drowsiness, convulsions, and coma).

Besides these systemic effects, an acute exposure can cause skin and/or eye problems. (Skin rashes are discussed in the following chapter and eye injuries in chapter XII.) Pesticides can damage the eyes as a result of accidental splashing or spilling, exposure to pesticide drift, or rubbing the eyes with contaminated hands. In addition to the effect of the active ingredients of pesticides on the eye, the "inert" solvents in which the active ingredients are mixed (e.g., xylene and petroleum distillates) produce severe inflammation (Davies, 1977).

Details of treatment modalities for the different classes of pesticides are presented in manuals by Morgan (1982) and Davies (1977).

Mortality and Morbidity Data

The true extent of pesticide-related mortality and morbidity among farmworkers is not known. Accurate documentation is hampered by a number of factors including the lack of a formal national reporting system.

A study of death certificates from 1956 to 1974 (see Table 40) showed changing trends in pesticide mortality. In 1956, 64% of the deaths were due to inorganic compounds (mainly arsenic), while in 1974 these accounted for only 13% of the total number of deaths due to pesticides. In contrast, deaths from organophosphates rose from 13% in 1956 to 35% in 1974. Children less than ten years of age accounted for 42% of the deaths in 1956 and 30% in 1974 (Moses, 1983).

A national study of patients hospitalized due to pesticide poisoning between 1971 and 1973 (U.S. Environmental Protection Agency, 1976) showed that the incidence rates ranged from 8.2 cases per 100,000 hospital admissions in 1971 to 8.5 in 1973. The incidence rate of work-related poisonings per 100,000 hospital admissions was 2.5 for this three-year period. Of the 192 pesticide-related deaths nationwide registered in the period, 24 were occupational, 48 were non-occupational, and 120 were intentional. In a follow-up study for the period 1974-1976 (U.S. Environmental Protection Agency, 1980), the incidence rates of pesticide poisonings due to occupational exposures were 2.0 in 1974, 2.8 in 1975, and 1.9 in 1976.

California is the only state where physicians are required by law to report all suspected pesticide-related illnesses and injuries to county and state health officials. Failure to do so, if proven, results in a fine. Even so, it is estimated that these reported cases reflect no more than 1-2% of the total actual number of cases of pesticide-related illness in the state (Kahn, 1976).

TABLE 40
DEATHS FROM PESTICIDES IN THE UNITED STATES
1956-1974*

Pesticides	*1956*	*1961*	*1969*	*1973*	*1974*
Inorganic, botanicals	98	58	44	28	16
Fumigants, solvents, etc.	6	6	7	5	4
Chlorinated hydrocarbons	13	6	5	3	1
Organophosphates	20	24	21	9	18
Carbamates	0	0	2	1	1
Other	15	17	8	15	12
Total	152	111	87	61	52

*Moses (1983) . p. 562. Adapted from Hayes (1976) and Hayes (1977).

California statistics for 1981 show a total of 1,093 cases of pesticide-related illness, of which 613 were agricultural; 235 of those cases occurred among field workers exposed to pesticides residues. These cases resulted in one day of hospitalization and 316 days of lost work (California Department of Food and Agriculture, 1982). Using Kahn's estimation above, the total actual number of pesticide-related illnesses among the 300,000 farmworkers in California would be between 11,750 and 23,500.

A review of pesticide poisioning data over the past ten years from the North Carolina Department of Human Resources showed that 43% of reported incidents occurred in agriculture (323 of 746 poisonings). Of those agricultural poisonings, 179 cases (55%) occurred during the planting months of April and May, the period in which soil incorporated pesticides and fumigants are applied (Hughes, 1985). This may indicate that farmworkers are at greater risk of poisoning during planting operations compared to harvesting activities, that farmworkers who harvest do not seek medical care or report pesticide poisonings when they occur as often as those involved in planting, or that persons involved in planting operations are more often farm owners or year-round farm employees rather than migrant or seasonal hired help and have better access to health care when poisonings occur.

Accurate estimation of illness or morbidity rates for pesticide-related health problems is difficult for various reasons:

(1) Many times farmworkers do not seek medical care when they become ill from pesticide exposure. Adult male farmworkers especially underutilize health care services. They may not want to lose work time and money to see a doctor, especially if their symptoms are not severe, or they may fear they will be fired if they seek care and report their poisoning. Additionally, medical facilities may not be accessible to them.

(2) Agricultural workers may not be covered under state workers' compensation laws, or coverage may only be partial. Even in those states where agricultural workers are fully covered, farmworkers may not be aware of their coverage. A 1973 study in California by Howitt (Kahn, 1976) found a 300-fold difference between the rate of pesticide-related illness occurring in a large sample of migrant and seasonal farmworkers and the rate of workers' compensation claims filed by those workers. The major reason for underreporting was the fact that only 8% correctly understood what workers' compensation was, and 70% of the farmworkers did not even know that such a thing as workers' compensation existed.

(3) Mild and moderate forms of pesticide-related illness are often misdiagnosed. Unless a physician takes an occupational history and is trained to recognize the signs and symptoms, cases of pesticide-related illness may be mistakenly attributed to influenza, gastroenteritis, or heat exhaustion. Even when the presenting symptom is a skin rash, the fact that the patient was engaged in farmwork may not be noted in the medical record.

(4) Determining actual pesticide exposure may be difficult. Farmworkers usually do not know what chemicals are used on the crops in which they work. They generally do not know when a field was last treated (unless they are injured as a result of a specific spraying incident). They may not come to a clinic until some days have passed, and their acute symptoms have subsided, by which time, blood and urine tests may register normal. With chronic, low-level exposure, farmworkers may not make a connection between contact with pesticides and their health problems. In addition, pre-exposure or baseline cholinesterase levels are generally not known for any particular patient and thus comparison data is not available to determine the actual amount of change from pre- to post-exposure levels when organophosphate or carbamate poisonings occur. This is particularly important because the "normal" range for cholinesterase levels covers a wide spectrum. A patient may fall in the high normal range before exposure and in the low normal after a mild

organophosphate poisoning. In both cases the blood test would still be in the normal range, but the amount of depression would be masked because the pre-exposure level was not known. (See Midtling et al., 1985.)

Chronic Health Effects

While the acute effects of pesticide poisoning are well known, the long-term effects of acute poisoning(s) or of low-level pesticide exposure over a number of years on farmworkers are less clearly understood.

There are methodological difficulties in studying the chronic effects of pesticides in the migrant farmworker population:

(1) Farmworkers' mobility precludes effective follow-up;
(2) It is difficult to determine extent of farmworker exposure due to lack of knowledge of which pesticides were used and when, the effect of different mixtures of pesticides, the wide range of pesticides used on the various crops any one worker may pick in a given season, and the seasonal nature of farmwork;
(3) The need to control for confounding factors, i.e., factors apart from pesticide exposure, that can affect health, such as poor nutrition and pre-existing health conditions; and
(4) The inaccessibility of farmworkers (e.g., isolated labor camps, language barriers).

These methodological problems are finally being addressed, and research projects such as the California farmworker pregnancy outcome study directed by Dr. Molly Coye are beginning to focus on the chronic health effects of pesticide exposure on farmworkers and their families.

The existing literature links pesticides to a range of chronic effects including cancer, birth defects, genetic damage, neurological, psychological, and behavioral effects, blood disorders, sterility, menstrual dysfunction, and abnormalities in liver and kidney function.

It is not possible to do an exhaustive review here of the pesticide literature regarding all of these known or suspected health effects; however, a discussion of some of these issues is presented in the following sections, and additional references are listed in chapter XX.

Carcinogenesis

Many widely used pesticides are known or suspected animal carcinogens (see Tables 41 and 42). Pesticides that are not in themselves carcinogenic may contain a contaminant that is carcinogenic (e.g., 2,3,7,8-TCDD in 2,4,5-T, ETU in Maneb, and dipropylnitrosamine in trifluralin). Several pesticides have the potential to react with nitrite to form N-nitroso compounds, many of which are known carcinogens (Moses, 1983).

Cancer studies involving agricultural workers have most consistently revealed an increased risk of leukemia, but higher than expected death rates have also been reported for a variety of cancers including prostate, stomach, skin, lip, pancreatic, kidney, lymphatic, and blood (hematopoietic) system cancers in farm populations. Some of these studies are reviewed in chapter XVI, and the role pesticides play in this increased mortality is discussed.

TABLE 41
PESTICIDES THAT ARE ANIMAL CARCINOGENS*

Aldrin
Amitrole
Aramite
Captan
Carbon tetrachloride
Chloramben
Chlordane
Chlorobenzilate
Chloroform
DDT
Diallate
Dibromochloropropane (DBCP)
Dieldrin
Ethylene dibromide
Heptachlor
Kepone
Mirex
Nitrophen
Tetrachlorvinphos
Toxaphene
Trifluralin

Note: Not all these are used in the United States, and some are no longer being manufactured.
*Moses (1983). Data from NIOSH.

TABLE 42
PESTICIDES THAT ARE SUSPECTED ANIMAL CARCINOGENS*

Azobenzene
Calcium cyanide
Chloroethyl triethyl ammonium chloride
Chloropicrin
2,4-D (isooctyl ester)
Dimethoate
Dimethoxane
Diphenylacetonitrile
Endosulfan
Endrin
Ethylan
Ethylene oxide
Hexachlorocyclohexane
Lindane
Mexacarbate
Pentachloronitrobenzene
Piperonyl butoxide
Piperonyl sulfoxide
Nabam
Propham
Strobane
2,4,5-T
Thiourea
Trichlorfon
2,4,6-Trichlorophenol

*Moses (1983). Data from NIOSH.

Teratogenesis (Birth Defects)

Table 43 lists those pesticides considered by the National Institute for Occupational Safety and Health (NIOSH) to be animal teratogens. NIOSH has determined that based on animal data, the following pesticides may pose a teratogenic problem for humans: aldrin, dieldrin, endrin, captan, captafol, folpet, thiram, and 2,4,5-T (Moses, 1983).

Schwartz et al. (1980) conducted a review of hospital records for all births (2,514) that occurred in a major hospital in Imperial County, California (a region of intensive agricultural production and pesticide use) during 1975-1978. The following variables were recorded: parents' residence, age, occupation, and ethnicity; prior pregnancy history; gestational history including risk factors such as smoking, alcohol consumption, and medications; birth weight, birth length, head circumference, presence and type of malformation, and incidence of stillbirths and neonatal disease or deaths.

The population was divided by parental occupation into agricultural and nonagricultural workers. The agricultural group included farm managers, farm laborers, pesticide applicators, tractor drivers, irrigators, and flaggers but not farm owners. This group accounted for 965 or 38.7% of the total live births.

For each birth defect and within each subgroup, ratios per 1,000 live births were calculated and compared to ratios published by the Centers for Disease Control (CDC) from the national Birth Defects Monitoring Program. While total prevalence of major malformations within the entire sample (40.6 per 1,000 live births) and among the progeny of agricultural workers (49.7 per 1,000 live births) was consistent with nationally accepted values, significant differences did occur for several defects.

TABLE 43
PESTICIDES REPORTED TO BE ANIMAL TERATOGENS*

Aldrin	Endrin
Azinphosmethyl (Guthion)	EPN
Captafol	Folpet
Captan	Maneb
Carbaryl	Parathion
Diazinon	Phosmet
Dichlorvos	2,4,5-T
Dicroptophos	Thiram
Dieldrin	Trichlorfon
Dimethoate	Trithion

*Moses (1983). Data from NIOSH.

After controlling for parental residence, parental ethnicity, parental age, and gestational exposure to medications, limb reduction defects occurred at significantly higher ratios than would normally be expected (based on CDC data) for both the total study population and the subgroup of infants of agricultural workers. Offspring of couples in which one or both parents were agricultural workers (N = 965) had a prevalence of 5.2 limb reduction defects per 1,000 live births compared to 1.3 such defects per 1,000 live births among the infants of parents not involved in agriculture. (The prevalence rate of such defects among the general population in the Western United States was 0.4 per 1,000 live births.)

In addition, a higher than expected ratio for Down's Syndrome, which appeared equally elevated for both the agricultural and non-agricultural subgroups, was found. In offspring of all mothers 15 to 29 years of age (N = 2,004), a twofold excess of Down's Syndrome was noted when the "observed" and "expected" ratios were compared. However, this excess did not prove to be disproportionately associated with parental work in agriculture, parental residence, parental ethnicity, or previous obstetrical history.

The authors cited small sample size, the limitations inherent in chart review studies (such as incomplete or inacurate medical records), and uncontrolled factors (e.g., exposure to organic fertilizers, livestock, pollens, climatic conditions, living conditions, food and water supply) as obstacles in definitively proving that pesticide exposure had caused the birth defects.

An extensive nationwide study to determine the prenatal, environmental, and medical factors leading to the various forms of cerebral palsy was designed in 1955 at the National Institutes of Health. This Collaborative Perinatal Project was able to follow 70% of the 58,760 children originally enrolled for seven years in order to evaluate not only immediate pregnancy outcome, but also disorders or abnormalities that might only manifest themselves in later childhood. Hunt and Harkness (1980) examined 23,961 records of this data base to analyze occupational exposures and pregnancy outcome/childhood abnormalities. Their analysis showed that women with a work history of pesticide exposure (N = 652) had the most adverse reproductive history, observed as more fetal deaths and stillbirths, premature low-weight babies with low five-minute Apgar scores, suspected neurological abnormalities at one year, and low I.Q. at four years. No statistically significant interaction with demographic variables was found, indicating that all socioeconomic and racial groups were affected similarly.

Gestational exposure to pesticides among humans also has been associated with increases in the rate of spina bifida and pure cleft palate (American Association for the Advancement of Science, 1972).

It is important to note that chemical exposure of *either* parent can lead to adverse birth outcome. For example, damage to spermatogenesis and sperm may result in chromosomal abnormalities and birth defects, stillbirths, or miscarriages.

DDT and its metabolites and analogues, lindane, heptachlor epoxide, and dieldrin have been detected in adipose tissue, the liver, adrenals, lungs, heart, brain, kidneys, and spleen of stillborns and infants who died in the early neonatal period, as well as in the cord blood of normal neonates (Curley et al., 1969), clearly indicating transplacental passage.

Other Reproductive Effects

Some pesticides have been associated with reduced fertility or sterility, e.g., DBCP (dibromochloropropane), which was banned for domestic use in 1979, and chlordecone (kepone). In a study of Colorado migrant farmworkers, high blood levels of organochlorine pesticides have been associated with menstrual dysfunction. Farmworker women with menstrual irregularities had average serum DDT levels which were twice the level found in women who did not have this complaint. Animal studies have shown alterations in menses and cystic changes in ovaries with administration of DDT (Chase et al., 1973).

Mutagenesis (Genetic damage)

Studies of workers occupationally exposed to a variety of pesticides (e.g., DDT, organophosphates) have uncovered chromosomal changes (Moses, 1983). Such chromosomal aberrations can result in spontaneous abortions, birth defects, stillbirths, or sterility. In addition, the ability of a substance to cause mutations is an indication that it may also be carcinogenic.

Neurological and Behavioral Abnormalities

Acute pesticide poisoning adversely affects the functioning of the central nervous system. Neurological and behavioral abnormalities including ataxia (loss of muscular coordination), tremor, vertigo, drowsiness, convulsions, coma, anxiety, confusion, depression, impaired concentration, defective memory, impaired language function, and inability to perform simple calculations have been attributed to pesticide exposure (Metcalf and Holmes, 1969; Rodnitzky et al., 1975). Neurobehavioral deficits may also include sensory effects such as loss of skin sensation (paresthesias, often the earliest manifestation of peripheral neuropathies), inability to smell (anosmia), auditory effects (tinnitis), and a rather wide range of visual problems from blurring and double vision to scotomas (areas of pathologically diminished vision within the visual field) and blindness (Anger, 1982). Whorton and Obrinsky (1983) found that four months after a poisoning of 19 California farmworkers with a combination of the organophosphates mevinphos and phosphamidon, 12 workers (63%) still suffered eye complaints such as blurred vision, discomfort while reading, and photophobia.

Peripheral neuropathy has been associated with only a very limited number of organophosphates and thus is not a common sequela to exposure to most organophosphates. However, since central nervous tissue does not recover as well as peripheral nerve tissue, more permanent disability can follow organophosphate neuropathy than follows exposure to toxic substances whose effects are limited to the peripheral nerves (Le Quesne, 1978).

Workers occupationally exposed to organophosphate pesticides have been shown to have abnormal electromyograms (a measure of muscle contractions) even when they were asymptomatic and had normal blood cholinesterase levels (Roberts, 1977; Roberts and Wilson, 1972; Jager et al., 1970).

The full range of cognitive effects and emotional changes associated with pesticide exposure is not known due to the difficulty in testing these functions and in establishing the normal range for the general workforce (Anger, 1982). Emotional problems attributable to pesticides can include tiredness, depression, anxiety, irritability, sleep disorders, and nervousness.

Savage et al. (1982) compared 100 individuals from Colorado and Texas who had suffered serious acute organophosphate pesticide poisoning between 1950 and 1976 (the case group) with 100 persons who had not experienced organophosphate poisoning (the control group) to detect any chronic neurological or neuropsychological effects in the case participants. The cases and controls were matched for age, sex, race, ethnic background, and socioeconomic factors. All study participants underwent physical examination, neurological examination, an EEG (electroencephalogram), and neuropsychological testing. Blood samples were tested for organophosphate pesticide residues and cholinesterase levels; hematology, morphology, urea nitrogen, and creatinine were also evaluated.

Seventy-eight percent (78%) of the cases had suffered poisoning severe enough to require hospitalization, and only four of the 100 cases were not occupationally related. Injured workers included: agricultural aircraft mixer/loaders and flaggers, cropduster pilots and mechanics, formulating plant employees, farmers and ranchers, agricultural specialty workers (greenhouse, nursery and ornamental plant workers, and horticulturists), as well as farm laborers and field workers.

The time lapse between a person's poisoning incident and neurological examination ranged from 117 to 9,640 days (4 months - 26 years), the average time lapse being 2,574 days (over seven years). Individuals who had experienced recent organophosphate exposures were ruled out as were those who had remained unconscious for more than 15 minutes at any time in their lives, had a past history of neurological illness, significant head trauma, or substance abuse; and those who had chronic diseases such as diabetes, renal failure, and pernicious anemia, which may produce neurologic impairment.

The cases and controls did not differ significantly in their physical examinations or EEG's. Some neurological deficiencies (e.g., one of the memory components of the mental status exam called "three-pairs-of-items" and peripheral sensory findings such as abnormal knee jerk) occurred more frequently in the case participants.

Although only a few differences in the neurological examination were significant, several major differences did occur between the case and control groups in the neuropsychological evaluations.

The cases scored significantly worse than controls on four of five summary measures and on 18 of 34 individual subtest scores used in the study. These differences occurred in intellectual functioning, academic skills, abstraction and flexibility of thinking, and simple motor skills (speed and coordination). The case group did not perform significantly better than the control group on any of the subtests.

Twice as many of the cases as controls had Halstead-Reitan Battery summary scores in the range that strongly suggested cerebral damage or dysfunction (24% versus 12%, $p < 0.05$). (The Halstead-Reitan Battery is the most comprehensive and best validated neuropsychological test battery currently available.) Both the case and control groups showed above average intellectual functioning on the Wechsler Adult Intelligence Study (WAIS).

The overall difference between cases and controls was further evaluated by simultaneously analyzing all 34 subtest scores in the neuropsychological evaluation. The difference was highly significant ($p = 0.0076$). In addition, for each battery of tests (WAIS, Halstead-Reitan, Peabody, and

Added Ability Tests) the difference between cases and controls was statistically significant. For each test battery for the two study subgroups from Colorado and Texas, the difference between cases and controls was consistent.

The case and control participants differed significantly in their own assessment of their functioning: the case group had lower scores in ten of 32 aspects of language and communication, memory, cognitive intellectual functions, and perceptual functions. The case participants also showed significantly lower abilities in the same subject areas on objective testing as they did on self-assessment.

Relatives also were asked to evaluate the study participants. Relatives of the cases rated them as having significantly more problems with depression ($p = 0.005$), irritability ($p = 0.001$), confusion about what was happening ($p = 0.036$), and withdrawal ($p = 0.046$). In addition, they were judged to have significantly more difficulty in understanding the speech of others ($p = 0.049$) and recalling the names of things ($p = 0.035$).

None of the poisoned individuals had sought medical care for chronic effects or claimed any noticeable decrease in their intellectual or psychological functioning as a result of their poisoning. The authors pointed out that it is not possible to generalize from these study results to the population of long-term organophosphate users who had not experienced a poisoning.

It is possible that the psychological differences between the case and control groups were due to confounding factors. The groups were matched on a demographic basis rather than on neurological or psychological factors. It may be that differences in psychological variables exist among individuals of different occupations but of a similar demographic background or that the significant difference in IQ level between the case and control groups might be responsible. Anxiety may also have influenced the responses on the psychological tests of those who knew they had been poisoned and that they were being tested for long-term effects.

It is not possible to conclude that the incidents of serious organophosphate poisoning caused the neuropsychological deficits observed in the case group. Other occupational or environmental exposures might be responsible for such differences, especially given that the average number of days from poisoning incident to neurological testing was over seven years.

This study shows the complementary nature of neurological and neuropsychological evaluations: clinical neurological examinations focus primarily on sensory and motor functioning, paying very little attention to the higher level cognitive intellectual functions, which are very sensitively assessed by neuropsychological procedures. Neither type of evaluation showed any differences between the cases and controls with respect to sensory-perceptual functioning. Neuropsychological examination found some mild impairment of fine coordination and motor speed with the upper extremities in the case group. Major neuropsychological differences between the two groups appeared on tests of abilities that are evaluated in only a limited fashion in a clinical neurological exam. The authors concluded that their results supported the position that the routine tools used for evaluation of clinical patients are not sensitive enough to reliably detect neurological deficits.

Other Body Systems

EPA data have shown associations between high serum pesticide levels of organochlorines and subsequent appearance of hypertension, arteriosclerotic cardiovascular disease, and possibly diabetes (Morgan, 1980). A study of workers heavily exposed to pesticides found abnormalities in liver and renal function (Tocci et al., 1969).

Blood disorders, including leukemia and aplastic anemia, have been associated with occupational (Blair, 1982) and non-occupational exposure to organophosphates and carbamates (Reeves, 1982). Pesticides are often dissolved in an organic solvent, such as xylene or other petroleum distillates. Xylene is an analogue of benzene, which has been shown to be both leukemogenic and mutagenic (NIOSH, 1977).

REFERENCES CITED

American Association for the Advancement of Science: Herbicide Assessment Report. *Congressional Record* 118(6):6896-6813, 1972.

Anger, W.K.: Neurobehavioral Testing in the Workplace. Paper presented at the annual meeting of the American Association for the Advancement of Science, Washington, D.C., January 1982. Dr. Kent Anger is with the Division of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health, 4676 Columbia Parkway, Cincinnati, OH 45226.

Barger, K. and Reza, E.: Survey of Midwestern Farmworkers (1983). Unpublished paper available from Ken Barger, Department of Anthropology, Indiana University-Indianapolis, Indianapolis, IN 46202 (phone: 317-264-3788) or Ernesto Reza, Department of Psychology, University of Michigan, Ann Arbor, MI 48109 (phone: 313-764-8397).

Blair, A.: Cancer Risks Associated with Agriculture: Epidemiologic Evidence. In *Genetic Toxicology: An Agricultural Perspective* (R.A. Fleck and A. Hollaender, eds.). New York: Plenum Press, 1982, pp. 93-111.

Brown, J.R., Chai, F.C., Chow, L.Y., et al.: Human Blood Cholinesterase Activity — Holland Marsh, Ontario, 1976. *Bulletin of Environmental Contamination and Toxicology* 19:617-623, 1978.

California Department of Food and Agriculture: Illnesses of Employed Persons Reported by Physicians as Due to Exposure to Pesticides or Their Residues in California in 1981 According to County of Occurrence. HS-982 February 22, 1982. Published by the Worker Health and Safety Unit, Division of Pest Management, Environmental Protection and Worker Safety, California Department of Food and Agriculture, 1220 N Street, Sacramento, CA 95814.

Chase, H.P., Barnett, S.E., and Welch, N.N.: Pesticides and U.S. Farm Labor Families. *Rocky Mountain Medical Journal* 70:27-31, 1973.

Chiriboga, J., Pagan, E., Eduardo, A., et al.: Levels of Cholinesterase in Blood of Pesticide Workers (abstract). March 29, 1985a. Contact: Jorge Chiriboga, M.D., Director, Environmental and Biomedical Sciences, Medical Sciences Campus, University of Puerto Rico, Rio Piedras, PR (phone: 809-751-0430).

Chiriboga, J., Pagan, E., Eduardo, A., et al.: Toxicological and Working Parameters for Puerto Rican Agricultural Migrants (abstract). March 29, 1985b. Contact: Jorge Chiriboga, M.D., Director, Environmental and Biomedical Sciences, Medical Sciences Campus, University of Puerto Rico, Rio Piedras, PR (phone: 809-751-0430).

Coye, M.J.: The Health Effects of Agricultural Production: I. The Health of Agricultural Workers. *Journal of Public Health Policy* 6(3):349-370, 1985.

Coye, M.J.: Testimony on OSHA Proposed Field Sanitation Standard. Presented May 24, 1984 in Washington, D.C. by Molly Joel Coye, M.D., M.P.H. (Governor's Office of Policy and Planning, State House, Room 232, Trenton, NJ 08625; phone: 609-292-6000 ext. 222). Entered into the field sanitation record as Exhibit No. 26 of Docket No. H-308.

Coye, M.J. and Fenster, L.: Personal communications with Molly J. Coye, M.D., M.P.H., Project Director (phone: 609-292-6000 ext. 222) and Laura Fenster, epidemiologist (phone: 415-540-2669), March and June 1984.

Curley, A., Copeland, M.F. and Kimbrough, R.D.: Chlorinated Hydrocarbon Insecticides in Organs of Stillborn and Blood of Newborn Babies. *Archives of Environmental Health* 19(5):628-632, 1969.

Davies, J.E.: *Pesticide Protection: A Training Manual for Health Personnel*. Washington, D.C.: U.S. Department of Health, Education, and Welfare and the U.S. Environmental Protection Agency, March 1977.

Farm Chemicals Handbook 1986. Willoughby, OH: Meister Publishing Co., 1986.

Florida Rural Legal Services, Inc.: *Danger in the Field: The Myth of Pesticide Safety*. May 1980 (Second printing, September 1980). Contact: Florida Rural Legal Services, Inc., 110 South Second St., P.O. Box 1109, Immokalee, FL 33934 (phone: 813-657-3681).

Guillen, A.: Information provided by Mr. Alfonso Guillen, Lab Manager, Pesticide Hazard Assessment Project, Texas Tech University, School of Medicine, P.O. Drawer 2031, San Benito, TX 78586 (phone: 800-858-7378), April 1984.

Hayes, W.J., Jr.: Mortality in 1969 from pesticides including aerosols. *Archives of Environmental Health* 31(2):61-72, 1976.

Hayes, W.J., Jr. and Vaughn, W.K.: Mortality from pesticides in the United States in 1973 and 1974. *Toxicology and Applied Pharmacology* 42(2):235-252, 1977.

Hughes, J.C.: Testimony at North Carolina Department of Labor Hearings on the Right to Know. April 29, 1985. For copies, contact: Mr. Joseph (Chip) Hughes, East Coast Farmworker Support Network, P.O. Box 1633, Raleigh, NC 27602 (phone: 919-682-3818).

Hunt, V.R. and Harkness, W.: Occupational Hazards to Pregnant Women in the Collaborative Perinatal Project. In: *Proceedings of A Workshop on Methodology for Assessing Reproductive Hazards in the Workplace, April 19-22, 1978* (P.F. Infante and M.S. Legator, eds.). Washington, D.C.: U.S. Government Printing Office, October 1980, pp. 377-404.

Jager, K.W., Roberts, D.V. and Wilson, A.: Neuromuscular Function in Pesticide Workers. *British Journal of Industrial Medicine* 27:273-278, 1970.

Kahn, E.: Epidemiology of Field Re-entry Poisoning. *Journal of Environmental Pathology and Toxicology* 4:323-330, 1980.

Kahn, E.: Pesticide Related Illness in California Farm Workers. *Journal of Occupational Medicine* 18(10):693-696, 1976.

Le Quesne, P.M.: Clinical Expression of Neurotoxic Injury and Diagnostic Use of Electromyography. *Environmental Health Perspectives* 26:89-95, 1978.

Metcalf, D.R. and Holmes, J.H.: EEG, Psychological, and Neurological Alterations in Humans with Organophosphorus Exposure. *Annals of the New York Academy of Sciences* 160:357-365, 1969.

Midtling, J., Barnett, P.G., Coye, M.J., et al.: Clinical Management of Field Worker Organophosphate Poisoning. *Western Journal of Medicine* 142:514-518, 1985.

Morgan, D.P.: *Recognition and Management of Pesticide Poisonings* (Third edition). Washington, D.C.: U.S. Government Printing Office, U.S. Environmental Protection Agency Publication No. 540/9-80-005, January 1982.

Morgan, D.P.: Morbidity and Mortality in Workers Occupationally Exposed to Pesticides. *Archives of Environmental Contamination and Toxicology* 9(3):349-382, 1980.

Moses, M.: Pesticides. Chapter 47 in: *Environmental and Occupational Medicine* (W.N. Rom, ed.). Boston: Little, Brown and Company, 1983, pp. 547-571.

National Institute for Occupational Safety and Health (NIOSH): *Occupational Diseases: A Guide to Their Recognition*. Washington, D.C.: U.S. Government Printing Office, DHEW (NIOSH) Publication No. 77-181, June 1977.

Quinones, M.A., Bogden, J.D., Louria, D.B., et al.: Depressed Cholinesterase Activities among Farm Workers in New Jersey. *The Science of the Total Environment* 6:155-159, 1976.

Reeves, J.D.: Household Insecticide-associated Blood Dyscrasias in Children (letter). *American Journal of Pediatric Hematology/Oncology* 4(4):438-439, 1982.

Richards, D.M., Kraus, J.F., Kurtz, P., et al.: A Controlled Field Trial of Physiological Responses to Organophosphate Residues in Farm Workers. *Journal of Environmental Pathology and Toxicology* 2:493-513, 1978.

Roberts, D.V.: A Longitudinal Electromyographic Study of Six Men Occupationally Exposed to Organophosphorus Compounds. *International Archives of Occupational and Environmental Health* 38:221-229, 1977.

Roberts, D.V. and Wilson, A.: The Toxicity of Pesticides in Man. In: *Toxicological Biodegradation and Efficacy of Livestock Pesticides*. (M. Khan and W. Haufe, eds.). Amsterdam: Swets and Zeitlinger, 1972, pp. 182-207.

Rodnitzky, R.L., Levin, H.S., and Mick, D.L.: Occupational Exposure to Organophosphate Pesticides. *Archives of Environmental Health* 30:98-103, 1975.

Rural America: Pesticides and You: A Guide for Farmworkers, Small Farmers and Rural Communities. Published by Rural America, 1302 18th St., N.W., Washington, D.C. 20036 (phone: 202-659-2800), 1980.

Savage, E.P., Keefe, T.J., Mounce, L.M., et al.: Chronic Neurologic Sequelae of Acute Organophosphate Pesticide Poisoning: An Epidemiologic Study. Final Report. April 1982. For information, contact: Dr. Eldon P. Savage, Project Director, Epidemiologic Pesticide Studies Center, Institute of Rural Environmental Health, Colorado State University, Fort Collins, CO 80523.

Schwartz, D., Newsum, L., and Heifetz, R.M.: Parental Occupation and Birth Outcome in an Agricultural Community. Unpublished paper, 1980. Project funded by the National Science Foundation and the Shalan Foundation. For a copy, contact: David Schwartz, M.D., 593 Quincy Shore Drive, Woollaston, MA 02170.

Spear, R.C., Popendorf, W.J., et al.: Worker Poisoning Due to Paraoxon Residue. *Journal of Occupational Medicine* 19:411-414, 1977.

Spigiel, R.W., Gourley, D.R., Holeslaw, T.L., et al.: Organophosphate Pesticide Exposure in Farmers and Commercial Applicators. *Clinical Toxicology Consultant* 3(1):45-50, 1981.

Tocci, P.M., Mann, J.B., Davies, J.E., et al.: Biochemical Differences Found in Persons Chronically Exposed to High Levels of Pesticides. *Industrial Medicine and Surgery* 38(6):188-195, 1969.

U.S. Environmental Protection Agency: *National Study of Hospitalized Pesticide Poisonings 1974-1976*. Publication No. EPA 540/9-80-001, July 1980. Published by U.S. EPA, Office of Pesticide Programs, Washington, D.C. 20460.

U.S. Environmental Protection Agency: *National Study of Hospital Admitted Pesticide Poisonings*. April 1976. Published by U.S. EPA, Office of Pesticide Programs, Washington, D.C. 20460.

Whorton, M.D. and Obrinsky, D.L.: Persistence of Symptoms after Mild to Moderate Acute Organophosphate Poisoning Among 19 Farm Field Workers. *Journal of Toxicology and Environmental Health* 11:347-354, 1983.

Wicker, G.W., Williams, W.A., and Guthrie, F.E.: Exposure of field workers to organophosphorus insecticides: sweet corn and peaches. *Archives of Environmental Contamination and Toxicology* 8:175-182, 1979a.

Wicker, G.W., Williams, W.A., Bradley, J.R., Jr., et al.: Exposure of Field Workers to Organophosphorus Insecticides: Cotton. *Archives of Environmental Contamination and Toxicology* 8:433-440, 1979b.

XI. Dermatitis

Dermatitis is the foremost occupational health problem in agriculture as well as in all industries. Occupational skin rashes among farmworkers can be caused by chemical or plant exposure. Patch testing is the method for determining the causative agent. Skin irritation by pesticides is exacerbated by environmental conditions, e.g., sweating skin, occlusive clothing or shoes, and damaged skin such as from sunburn or eczema. Skin infections such as scabies and impetigo may be spread through unsanitary working conditions.

Sensitization to pesticides can lead to chronic, debilitating skin rashes, especially on the hands, which may force a farmworker to abandon agricultural work. Temporary disabilities from work days lost due to dermatitis lower the earning power of farmworker families.

Skin problems are the most frequently reported occupational disease in both agriculture and all industries. National statistics for 1982 show that "skin diseases and disorders" accounted for 40% of all occupational illnesses and injuries (Bureau of Labor Statistics, 1983). Statistics for Florida for 1981 show that 55% of all occupational illness and injury was skin-related (Florida Department of Labor and Employment Security, 1983). The rate of occupational skin disease for all California industries combined was 2.1 cases per 1,000 workers in 1977. The rate for agriculture was 8.6, for manufacturing 4.1, for construction 2.5, and for mining 2.0 per 1,000 workers. While agriculture represented only 3% of state employment, it accounted for more than 13% of all occupational dermatoses (Coye, 1985).

Determining the cause of dermatitis among farmworkers can be complicated given the wide range of exposures they experience. Skin inflammation and rashes may be due to:

- Poisonous plants (poison ivy, oak, and sumac) and weeds
- Contact with or ingestion of crops
- Pesticides and other farm chemicals such as fertilizers and lime
- Ultraviolet radiation
- Infections due to unsanitary working or living conditions
- Secondary infection from scratches, insect bites, etc.

Plants

Without patch testing, it may be difficult to determine whether a skin rash is caused by chemical or plant contact. *Rhus* (poison ivy, oak, and sumac) belongs to the Anacardiaceae family, like the cashew nut tree and mango; more than 20 genera are allergenic. The contact usually takes place by direct touch but may occur via contaminated tools or clothing (Fregert, 1981).

Other plants that produce contact dermatitis include ragweed, philodendron, flowers such as lilies, tulips, and daffodils, and some of the very crops that farmworkers harvest including lettuce, celery, onion, garlic, cucumbers, asparagus, mustard, barley, corn, rice, apples, and pears (Fregert, 1981; Mitchell and Rook, 1979).

A skin rash may also result from a farmworker's eating some of a crop that causes an allergic reaction (e.g., strawberries and mangoes).

The majority of cases of occupational dermatoses among California farmworkers in 1977 were due to plant exposures, primarily poison ivy; 16% were attributed to agricultural chemical exposure (Coye, 1985).

Pesticides

The agricultural worker who is exposed to pesticides is four times more likely to develop a skin rash than the average industrial worker (Davies, 1977).

Pesticide-caused dermatitis can result either from exposure to primary irritants or from contact with allergens or contact sensitizers.

Primary Irritants

Primary irritants are divided into two types: absolute or relative. Absolute irritants are usually chemicals that can cause a chemical burn or severe irritation on almost anyone's skin. The reaction occurs immediately or within an hour or so. Relative irritants can cause varying degrees of dermatitis according to environmental conditions. For example, kerosene and turpentine are more likely to cause problems on sweat-covered skin or under occlusive clothing and boots. All are more damaging to skin that is already abnormal, for example, suffering from sunburn or eczema, which is dermatitis caused by internal rather than external factors (Davies, 1977).

The following facts help explain the high risk of dermatitis for farmworkers:

(1) The most common route of farmworker exposure to pesticides is dermal.
(2) Farmworkers do strenuous labor in hot and humid climates, which causes heavy perspiration.
(3) Some active pesticide ingredients are dissolved in organic solvents such as xylene and kerosene.
(4) Hand harvesters rarely wear protective clothing to prevent absorption of chemicals. Such protective clothing can be expensive, is generally not provided by the employer, may be very hot to wear (e.g., neoprene boots, gloves, coat), or may slow down the picker's work pace — which means reduced wages.
(5) Cracked, chapped, sunburned, or otherwise damaged skin is common among farmworkers because of the nature of outdoor work and the possibility of cuts and scrapes from thistles, branches, etc.

When handwashing facilities are not available at the worksite, primary irritants can contaminate other more susceptible parts of the body. The genitalia and eyelids are particularly vulnerable. When irritants are absorbed in clothing and boots, rashes appear where there is closest contact with the skin — the buttocks, knees, and bottoms of the feet.

Treatment of dermatitis caused by primary irritants includes removing the patient from further exposure and applying topical steroid creams to the affected areas.

Contact Sensitizers

Contact sensitizers, in contrast, may cause an allergic reaction in only a small percentage of workers who have become sensitized to the particular substance. There may be marked differences between individuals in the severity of the dermatitis. The reaction may occur within a few hours of contact or take as long as a week to become apparent. Most reactions occur within 48 hours and are characterized by redness, itching, swelling (especially around the eyes), and exudation, leading to crusting or scaling. More chronic changes include thickening (lichenification), excoriations, and often hypo- or hyperpigmentation (Arndt, 1983).

Ninety percent (90%) of occupational contact dermatitis occurs on the hands, which can force the patient to stop working (Fregert, 1981). This is of special concern for farmworkers who are not salaried employees and may not be covered under any workers' compensation program.

A large number of pesticides in common use have been reported to cause sensitization as well as direct irritant dermatitis. In these cases, the farmworker may have to permanently abandon working on a certain crop or range of crops on which that pesticide is used. In California in 1977, 26% of the pesticide-related dermatoses necessitated disability leave. The economic as well as the health consequences of pesticide-related dermatitis are therefore significant for farmworker families (Coye, 1985).

Treatment of allergic contact dermatitis includes using cool compresses, treating infections, and identifying the substance causing the reaction. Patch testing — which is rarely used on farmworkers because of its expense, their inaccessibility to a facility that does patch testing, and the time involved — can identify the offending agent.

As with primary irritants, topical steroid creams, gels, or lotions are beneficial. Steroid injections may be necessary to treat severe or extensive cases; however, systemic steroid therapy is contraindicated in patients who may have undetected tuberculosis or are at risk for developing tuberculosis (Davies, 1977). This is an important caveat for farmworkers given the higher rates of tuberculosis found in migrant populations.

Pesticides reported as sensitizers include the thiuramsulfides (e.g., TMTD, TMTM), dithiocarbamates (ziram, ferbam, maneb, zineb, nabam, etc.), captan, ethylenediamine, mercaptobenzothiazole, rodannitrobenzene, dithianone, dichlorvos, o-difolatan, atrazine, benomyl, o-o-diethylphtalimido-phosphothioate, nitrofurazone, naphthylthiourea, 2,6-dinitro-o-cresol, diethyl-phthalimidophosphothioate, and captafol (Fregert, 1981).

Migrant Health Data

Clinic data presented in chapter V of this report reflect the significance of dermatitis among the farmworker population:

(1) The 1981 survey of federally funded migrant health centers conducted by the National Association of Community Health Centers revealed that 89% of upstream and 43% of downstream centers reported dermatitis as a frequent diagnostic problem (ranked first and eighth, respectively) (Hicks, 1982).

(2) North Carolina farmworkers surveyed in 1981 reported that about two-thirds of their work-related health problems were dermal (Ehrlich and Hardgrave, 1981).

(3) In Michigan, dermatitis was MARCHA's (Migrant and Rural Community Health Association) sixth most frequent diagnosis among migrant farmworker patients (MARCHA, 1978).

(4) At the Sparta Health Center in Michigan, migrant farmworker patients between the ages of 25-64 years had twice the rate of contact dermatitis as non-migrant patients (approximately 3% versus 1.5%). Among 25-44-year-olds, contact dermatitis was the ninth most frequent medical problem for which care was sought (Sparta Health Center, 1979).

(5) One-fourth of Idaho farmworkers surveyed in 1976 reported skin rashes (Bondy et al., 1976).

During the four-month harvest in 1983 the Michigan Department of Public Health studied two migrant health centers with multiple clinics to determine the extent of pesticide-related dermatitis (Michigan Department of Public Health, 1984). A pesticide health history form was designed to collect pesticide exposure and other pertinent data.

There were 521 (4.5%) diagnosed cases of dermatitis, poison ivy, and rashes among the 11,569 encounters at three southwestern Michigan clinics. Of these, ten cases or 0.09% of total encounters (2% of the total dermatologic symptomatology) were suspected of being caused by pesticide exposure.

The authors concluded that pesticide-associated dermatologic conditions do not appear to be a significant health factor within the migrant farmworker population in Michigan. They noted, however, that it was not known how many cases went untreated and unreported or how many were treated with home remedies or at health care facilities other than migrant health clinics, such as local physicians' offices or hospitals. In addition, skin patch testing was not performed as part of the study, which would have definitively identified the causative agent in each case of dermatitis.

REFERENCES CITED

Arndt, K.A.: Skin Disorders. Chapter 19 in: *Occupational Health: Recognizing and Preventing Work-Related Disease* (B.S. Levy and D.H. Wegman, eds.). Boston: Little, Brown, and Company, 1983.

Bondy, M.K., Lebow, R.H., O'Malley, M. et al.: *Occupational Health and Safety for Agricultural Workers*. Washington, D.C.: U.S. Government Printing Office, DHEW (NIOSH) Publication No. 77-150, December 1976.

Bureau of Labor Statistics: Occupational Injuries and Illnesses in the United States by Industry, 1982. Washington, D.C.: U.S. Department of Labor, 1983.

California Department of Industrial Relations: Occupational Skin Disease in California. San Francisco: Division of Labor Statistics and Research, January 1982. For copy of report, contact the Division at: P.O. Box 603, San Francisco, CA 94101.

Coye, M.J.: The Health Effects of Agricultural Production: I. The Health of Agricultural Workers. *Journal of Public Health Policy* 6(3):349-370, 1985.

Davies, J.E.: *Pesticide Protection: A Training Manual for Health Personnel*. Washington, D.C.: U.S. Department of Health, Education, and Welfare and U.S. Environmental Protection Agency, March 1977.

Ehrlich, S.P. and Hardgrave, S.W.: Pesticide Poisoning and Other Occupational Hazards among North Carolina Farmworkers. Unpublished paper, 1981. Available from Bea Bobotek, Librarian, Migrant Legal Action Program, Inc., 2001 "S" Street, N.W. #310, Washington, D.C. 20009.

Florida Department of Labor and Employment Security: *Occupational Injuries and Illnesses in Florida, 1981*. Tallahassee: Division of Workers' Compensation, 1983.

Fregert, S.: *Manual of Contact Dermatitis* (Second Edition). Chicago: Year Book Medical Publisher, 1981.

Hicks, W.: Migrant Health: An Analysis. *Primary Care Focus*, July/August 1982, pp. 6-23. Published by the National Association of Community Health Centers, Inc., 1625 "I" St., N.W. Suite 420, Washington, D.C. 20006 (phone: 202-833-9280).

MARCHA: Table on most frequent diagnoses for migrant and non-migrant patients, 1978. Contact: Mrs. Jane Miller, R.N., M.S.N., Director of Primary Care, Migrant and Rural Community Health Association (MARCHA), P.O. Box 130, Bangor, MI 49013 (phone: 616-427-7937).

Michigan Department of Public Health: Epidemiological Assessment of Environmental Health Hazards in Rural Migrant Populations During 1983. Lansing: Division of Epidemiological Studies, Center for Environmental Health Sciences, March, 1984. For a copy of this unpublished report, contact: Mr. Art Bloomer, Division of Epidemiological Studies, Michigan Department of Public Health, 3500 N. Logan, P.O. Box 30035, Lansing, MI 48409 (phone: 517-373-2037).

Mitchell, J. and Rook, A.: *Botanical Dermatology: Plants and Plant Products Injurious to the Skin*. Vancouver: Greengrass, 1979.

Sparta Health Center: A Study of the Medical Conditions and Supplementary Health Conditions of Migrant Farmworkers. Unpublished data, 1979. Contact: Ms. Kirsten Lundeen, Project Officer, Division of Health Care Systems, Department of Public Health, 3500 N. Logan, P.O. Box 30035, Lansing, MI 48909.

XII. Eye Problems

Untreated vision problems are common among farmworkers. Occupational hazards for the eyes include irritation, infections, or injury from: the wind, sun, dust, or soil; agricultural chemicals; twigs, branches, and thorns; stones and debris ejected from farm machinery; and allergic reactions to plants. The results of eye injury can range from itching, redness, swelling, and excessive watering to partial or complete blindness or loss of the eye.

Given the serious consequences of eye injury, farmworkers should be given preventive and first-aid training to protect their sight. Clean water in adequate amounts is needed in the fields for handwashing and first-aid treatment in order to flush pesticides or foreign matter from the eyes.

Vision needs among farmworker families remain largely neglected. Two vision screening projects — one involving 1,484 migrant farmworkers in California, the other of 505 migrant and seasonal farmworkers and their families in Oregon — showed screening failure rates of 31% and 53%, respectively. In Oregon, 58% of the seasonals and 47% of the migrants screened were classified as "problematic." These screening projects have been expanded to include North and South Carolina, Texas, Ohio, and Florida (Association of Schools and Colleges of Optometry, 1984).

In this chapter, we will focus only on work-related eye problems.

Irritation/Allergies

Dust causes inflammatory reaction in the eyes: blepharitis (inflammation of the eyelid) and conjunctivitis (inflammation of the conjunctiva or mucous membrane that lines the inner surface of the eyelids). Pterygium is an abnormal vascular membrane over the eye that is believed to grow in response to chronic irritation from wind and dust. In some cases, pterygium extends onto the cornea and interferes with vision.

Results from the Association of Schools and Colleges of Optometry (ASCO) vision screening project of 1,484 migrant farmworkers and their families in California showed the following:

(1) Approximately 2% (4/236) of the 10-19-year-olds who failed the screening did so due to conjunctivitis, and 8% (18/236) failed because of blepharitis.

(2) Among the 61 20-44-year-olds who failed the screening, five (8%) did so because of pterygium.

(3) The failure rates due to pterygium and to blepharitis in the 45-64-year-old group were 28% (10/36) and 11% (4/36), respectively.

(4) In the 65-and-over group, blepharitis accounted for 16% (4/25) of the failure to pass the screening test, while pterygium was responsible for 24% (6/25) (Association of Schools and Colleges of Optometry, 1984).

Bondy et al. (1976), in their survey of 99 farmers and 72 farmworkers in Idaho, reported one case of work-related pterygium; however, the authors stated that the examining physicians did not consider incipient pterygium important and did not note it in patient records. Thus, they believed pterygium to be more prevalent than the clinic records indicated.

Prolonged exposure to flowers or fruits can cause allergic inflammation of the conjunctiva as well as of the skin (dermatitis venenata) (Blake, 1975).

Trauma

Leaves and twigs can cause corneal abrasions. Simple corneal abrasions usually heal rapidly; progression to ulceration may indicate presence of bacterial infection. Fungal infection, for example by *Aspergillus fumigatus*, or bacterial infection by actinomyces, usually follow minor trauma, especially from vegetation contaminated by soil. The risk of fungi becoming pathogenic is greatly enhanced by the practice of using antibiotics and corticosteroids in the eye to deal with trivial or self-limiting eye disorders (Blake, 1975).

A blow from a branch can cause a concussion cataract. Thorns readily perforate the eye and can penetrate to a depth of 6 or 7 mm, even opening the anterior capsule of the lens. Often the corneal wound seals itself or is plugged by uveal tissue. It takes time for the lens to become opaque so that the affected farmworker may not complain of vision loss until several days after the accident (Blake, 1975).

The hairs on plants, seeds, fruit, and burs also are capable of burrowing into the cornea and the conjunctiva and causing a severe nodular reaction, which may include accumulation of pus in the cavity between the cornea and lens (Blake, 1975).

Insects also can enter the eye, and their bites or stings can cause inflammation around the eye.

Pesticides

Pesticides cause eye injuries in several ways:

- From accidental splashing or spraying,
- By exposure to pesticide drift, and
- By rubbing the eyes with contaminated hands or clothing.

These chemicals act mainly on the exposed structures of the eye, the cornea and the conjunctiva. The degree of injury largely depends upon the length of time the chemical is in contact with the eyes as well as the concentration and nature of the chemical. The depth of penetration through the outer eye tissues depends upon the water or fat solubility of the chemical. Although both acid and alkaline substances cause a rapid coagulation of proteins with death of the damaged cell, alkalis are capable of causing greater damage by breakdown (saponification) of the cellular barriers of the eye (Blake, 1975).

Pesticide exposure can cause conjunctivitis, corneal ulceration, uveitis (inflammation of the posterior pigmented layer of the iris), lenticular and corneal opacities, and destruction of the conjunctiva (Blake, 1975; Davies, 1977). Corneal grafting may be necessary to restore sight in cases of severe corneal injury. If the conjunctiva is destroyed it may be replaced by fibrous tissue so that apposed areas on the eyelid and the globe may become fused together (symblepharon). This structural alteration lessens conjunctival secretion and may restrict the movement of the eye and the eyelids as well as expose an already damaged cornea (Blake, 1975).

Pesticides also have a delayed effect on visual accommodation (the automatic adjustment of the eye for seeing at different distances caused by changes in the convexity of the lens) and diminish the peripheral fields of vision (Davies, 1977).

Besides the active ingredients of pesticides, pesticide solvents such as xylene, kerosene, and other petroleum distillates also cause eye injury, being very irritating and producing severe inflammation.

First-aid treatment for pesticides in the eye consists of flushing the eye with large amounts of clean water. As stated earlier, the degree of damage depends largely upon the duration of exposure. Thus, the absence of clean water in the fields puts farmworkers at increased risk of serious eye injury from pesticides. Given the serious consequences of this type of injury, workers must have an adequate supply of clean water for regular handwashing and for emergencies, as well as first-aid information and training about general work safety to minimize exposure to pesticides.

Other Farmworker Health Data

The information available on eye problems among migrant farmworkers includes migrant health center data and statewide work-related accident reports, which generally do not distinguish between field workers and other classifications of farm laborers (e.g., farmers, tractor drivers, pesticide applicators).

Clinic data cited in chapter V show that eye problems are frequent among farmworker patients.

(1) Conjunctivitis was the ninth most frequent medical problem seen among migrant farmworkers at the Sparta Health Center in Michigan. It accounted for almost 3% of the diagnosed conditions in migrants versus about 1% in non-migrants (Sparta Health Center, 1979).

(2) In Wisconsin, eye problems rated as the second most common health complaint among adult migrant farmworkers (31.7%) (Slesinger and Cautley, 1981).

(3) A 1983 health screening project of 188 adult male migrant and seasonal farmworkers in Utah (Viavant et al., 1983) found that *almost half* of all clients complained of eye problems: itching, burning, fatigue, watering, or blurred vision. This far exceeded the number of workers with problems of visual acuity (12% farsighted and 22% nearsighted).

Workers' compensation statistics for California in 1976 show that eye injuries accounted for 6.4% (943/14,709) of total disabling work injuries and illnesses in the agricultural industry (California Department of Industrial Relations, 1978). Of these injuries, 25% were caused by flying particles, 15% by chemicals, and almost 10% by thorns, stalks, vines, or brush. Workers in fruit and nut tree crops were most at risk for eye injuries: 10.4% of injuries in these crops involved trauma to the eye, compared to 3.2% of injuries in vegetable and melon crops and 5.5% of injuries in field crops. The higher injury rate is probably due to the increased risk of trauma from tree branches, leaves, and flying particles from pneumatic saws used for pruning and thinning trees.

California statistics for 1981 regarding pesticide poisonings reveal that 6.3% of injuries among field workers exposed to pesticide residue occurred to the eyes (California Department of Food and Agriculture, 1982).

The extent of these injuries is underestimated by workers' compensation statistics given the fact that many farmworkers either do not know about workers' compensation or work in states with only partial or no coverage of agricultural workers.

Given the serious consequences of eye injuries, farmworkers should receive training on first-aid measures as well as appropriate preventive steps (e.g., being provided with safety glasses to wear when pruning trees), ways to minimize pesticide exposure, and correct hygiene at the workplace. They must also have available an adequate supply of clean water to both wash their hands and flush the eyes in case of an emergency.

REFERENCES CITED

Association of Colleges and Schools of Optometry: Progress report from the Southern California College of Optometry, June 30, 1984 and paper entitled "Optometric Services in Migrant Health Centers: A Demonstration Project" by Drs. Alan W. Reichow and William B. Bleything, Pacific University College of Optometry, Forest Grove, Oregon 97116, dated November 12, 1984. Contact: Mr. Lee Smith, ASCO, 600 Maryland Ave., S.W., Suite 410, Washington, D.C. 20024 (phone: 202-484-9406).

Blake, J.: Eye Hazards in Rural Communities. *The Practitioner* 214:641-645, May 1975.

Bondy, M.I., Lebow, R.H., O'Malley, M. et al.: *Occupational Health and Safety for Agricultural Workers*. Washington, D.C.: U.S. Government Printing Office, DHEW (NIOSH) Publication No. 77-150, December 1976.

California Department of Food and Agriculture: Illness of Employed Persons Reported by Physicians as Due to Exposure to Pesticides or Their Residues in California in 1981 According to County of Occurrence. HS-982 February 22, 1982. Published by: Worker Health and Safety Unit, Division of Pest Management, Environmental Protection and Worker Safety, California Department of Food and Agriculture, 1220 N Street, Sacramento, CA 95814.

California Department of Industrial Relations: Occupational Skin Disease in California. San Francisco: Division of Labor Statistics and Research, January 1982. For copy of report, contact the Division at: P.O. Box 603, San Francisco, CA 94101.

Davies, J.E.: *Pesticide Protection: A Training Manual for Health Personnel*. Washington, D.C.: U.S. Department of Health, Education and Welfare and the U.S. Environmental Protection Agency, March 1977.

Slesinger, D.P. and Cautley, E.: Medical Utilization Patterns of Hispanic Migrant Farmworkers in Wisconsin. *Public Health Reports* 96(3):255-263, 1981.

Sparta Health Center: A Study of the Medical Conditions and Supplementary Health Conditions of Migrant Farmworkers. Unpublished data, 1979. Contact: Ms. Kirsten Lundeen, Project Officer, Division of Health Care Systems, Department of Public Health, 3500 N. Logan, P.O. Box 30035, Lansing, MI 48909.

Viavant, P., Ratcliffe, S., and Olsen, D.M.: Male Screening Project: Final Report. November, 1983. Unpublished paper available from Dr. Donna Olsen at the Utah Migrant Health Project, Utah Rural Development Corporation, 12 East Center Street, Midvale, UT 84047.

XIII. Musculoskeletal Problems

Heavy physical labor contributes to a variety of musculoskeletal problems, which include traumatic injuries, conditions in which joint tissue is irritated, and degenerative joint disease such as osteoarthritis of the hands, knees, and hips.

Farmworkers are occupationally exposed to many of the risk factors associated with musculoskeletal injury such as lifting and carrying heavy containers, difficult work positions such as stooping and forward bending, an excessively fast work pace, and whole body vibration.

Clinic and survey data show that musculoskeletal problems are frequent complaints of farmworkers. A nationwide study of disabled farmworkers found that over one-third of the respondents cited a musculoskeletal injury or condition as the cause of their impairment.

Prevention of musculoskeletal conditions can be aided by changes in the workplace. For example, the decline in use of the short-handled hoe in California between 1965 and 1970 resulted in a 34% decrease in sprain or strain injuries among agricultural workers.

Musculoskeletal or rheumatic syndromes associated with occupational or industrial activities can be classified into three general categories: traumatic injuries, irritation of the tissues surrounding the joints, and accelerated degeneration of the joints. Much of the information on these syndromes is still anecdotal (Williams and Ward, 1983); however, despite the lack of formal proof that specific types of labor precipitate musculoskeletal disease, there are strong associations between actions involving repetitive motion or excessive effort (or both) and musculoskeletal problems (Andersson, 1981; Jurmain, 1977; Kelsey, 1982; Partridge and Duthie, 1968; Wickstrom, 1978; Williams and Ward, 1983). These problems include back and shoulder strain, osteoarthrosis (also called osteoarthritis or degenerative joint disease), lumbago (low back pain), sciatica (a syndrome characterized by pain radiating from the back into the buttock and leg, which is most commonly caused by prolapse of the intervertebral disc), herniated lumbar intervertebral discs, and nerve compression (e.g., carpal tunnel syndrome, which affects the hands, wrists, and sometimes the forearm).

Few of the formal studies have dealt with agricultural populations; none has examined migrant farmworkers. The industrial literature, however, shows that farmworkers are occupationally exposed to many of the risk factors associated with musculoskeletal injury. For example, the occupational factors that contribute to back strain include previous back injury, heavy lifting and carrying, difficult work positions (e.g., forward bending, prolonged kneeling), an excessively fast work pace, whole body vibration, and work in cold and damp climates (Wickstrom, 1978). Bad posture may lead to back injury through imbalance between muscles in lifting, and postural fatigue, such as that caused by prolonged forward bending, predisposes the worker to back injury (Brown, 1973; Wickstrom, 1978).

Farmworkers carry heavy bushels and buckets of produce and lift them up above their heads to empty into trucks. Orchard workers wear canvas bags on their shoulders that they fill with fruit as they climb up and down ladders. Mushroom workers stand on catwalks five feet high and stretch across the beds to pick mushrooms and to load and unload the beds with dirt. Farmworkers spend long hours bent over low-lying crops such as cucumbers, beans, strawberries, and squash.

The short-handled hoe (*el cortito* or *la mano del diablo* — the devil's hand) was banned in California in 1975, in Texas in 1981, in Arizona in 1984, and in Washington state in 1985. There is, however, no national ban on its use, and prolonged labor in this doubled-over position is linked to back strain, arthritis, hernias, breathing impairment, and stomach, heart, and bladder ailments because of the unnatural pressure it causes. Respiratory problems are also involved because it is easier for pesticide residues to be raked up into the farmworkers' faces when they labor stooped over (New York Times, 1984; Ortiz, 1984). Even hoeing with a long-handled hoe (e.g., beets) can result in back and shoulder pain (Jamieson, 1969).

Chronic orthopedic conditions such as scoliosis and lordosis of the vertebral column, chronic aching back and shoulders, and circulatory insufficiencies in the lower extremities from hours of standing have been reported among mushroom workers (U.S. Commission on Civil Rights, 1977).

A study of Japanese strawberry and eggplant workers in greenhouses showed that the bent-over position caused fatigue in the lower back and shoulders: more than 50% of both strawberry and eggplant pickers complained of low back pain and shoulder stiffness (Maeda et al., 1980).

In addition, farmworkers who drive tractors and trucks are subjected to whole body vibration. There is speculation that repetitive small trauma, such as certain types of vibration, can cause permanent damage to structures of the spine. Some studies have linked work-related vibration with back pain (Andersson, 1981).

Traumatic Injuries

Agricultural accidents can cause trauma to the musculoskeletal system in a variety of ways. Falls from ladders can cause broken bones or spinal injuries. Crushing accidents, such as being run over by a tractor, account for many fractures of the pelvis. Limbs may get caught in machinery, leading to amputated fingers or smashed bones and joints (Jamieson, 1969).

Strenuous exertion or direct trauma can cause rupture of a muscle or its tendon, or a muscle strain. Sprains are injuries resulting in stretching or tearing of ligaments. They occur when a joint is forced beyond its normal range of motion, with increased stress on the supporting ligaments. Injury to a joint by a direct blow, twisting, or forced hypermobility can result in swelling and pain. Slips, falls, and improper lifting of heavy loads can result in acute back sprain or a herniated disc (Williams and Ward, 1983).

Trauma may also be the result of fights among farmworkers or due to crewleader abuse (Parker and Hemingway, 1981).

Irritation of Joint Tissues

Repetitive movements or trauma are a frequent cause of bursitis. Any unusual repeated motion can lead to bursal inflammation. Repeated motions or unusual activity can also lead to tendinitis, most commonly in the shoulder, elbow, wrist, thumb, and ankle (Williams and Ward, 1983).

"Frozen shoulder" is a term that covers a variety of problems that limit arm and shoulder function; it is common among agricultural workers. It often affects workers who drive tractors and manipulate levers behind them, those who lift and carry or hoe in the fields, and those who work at objects above their heads as in lopping branches and pruning fruit trees. This condition may follow an acute injury, but more often it is insidious and occurs more commonly in the middle-aged and elderly. Pain occurs when the arm is raised to the horizontal level and in such activities as thrusting the arm into a coat sleeve. This problem causes protracted disability because it is very resistant to treatment (Jamieson, 1969).

Nerve entrapment or compression may occur because of direct trauma or repetitive actions. A muscular band or a fibrous tunnel or some other anatomical structure compresses the nerve; this irritation causes swelling and inflammation, which in turn cause continued compression and inflammation. Pain is a prominent feature and is usually present at rest. Discomfort may increase at night and is sometimes exacerbated by a specific activity (Williams and Ward, 1983).

The most common type of nerve entrapment is the carpal tunnel syndrome, in which the median nerve is compressed in the carpal tunnel. This condition is often associated with the performance of specific manual tasks, such as twisting, cutting, or squeezing for extended periods of time. The condition is more common in women than men, and the difference in wrist size has been implicated; however, the hands of women who develop the syndrome do not differ from those of women who do not (Williams and Ward, 1983).

Accelerated Degeneration of the Joints

Researchers agree that hard physical work promotes degenerative joint disease. What is less clear is exactly what types of wear and tear are most detrimental.

The National Health Interview Survey data file contains information on self-reported conditions and injuries from a sample of U.S. households. Analysis of these data reveals that agricultural workers have a higher prevalence of arthritis than white collar, blue collar, service, or all workers combined. Seventeen percent (17%) of all conditions reported among farmers and farm managers during the period 1969-1977 were musculoskeletal and connective tissue diseases, versus 12% for all occupations combined. Musculoskeletal conditions were the most frequently reported ailments among both male and female farmers and farm managers; farmers reported over 50% more musculoskeletal disease than farm managers. Arthritis represented 68% of musculoskeletal disease reported by male farmers and 74% of that reported by female farmers (Coye, 1985).

Social Security Administration data show that 17% of disability awards granted to male farmers, and 23% of those made to females, were attributable to musculoskeletal and connective tissue disease, making it the second leading cause of disability among farmers of both sexes. The rigorous physical work of farming is presumed to be responsible for this excess in musculoskeletal disease, although no studies have been done to identify equipment, tools or work practices that are specifically associated with these adverse outcomes (Coye, 1985).

Williams and Ward (1983) reported farmers to be at increased risk of developing degenerative arthritis of the hips.

A study of cotton pickers showed that they had high rates of osteoarthrosis of the fingers, although few of the workers had had finger injuries (Lawrence, 1961). Partridge and Duthie (1968) postulated, however, that the finger joints of these workers may be subject to continual minor trauma.

Research has indicated that mechanical stress causes "minitraumas" that when repeated on frequent occasions will cause disc degeneration. Heavy physical labor may cause detectable (by x-ray) spinal degeneration that develops up to ten years prematurely (Wickstrom, 1978).

Degenerative processes starting later in life lead to gradual narrowing of the disc spaces and loss of tension in the disc nucleus, to bony outgrowths at the edges of vertebrae and arthritic changes in the many small posterior joints of the spine. Workers afflicted with this spinal degeneration may never have had back troubles, but an unexpected twist or jarring of the spine will provoke severe and lasting discomfort that may well lead to permanent mild disability (Jamieson, 1969).

The importance of degenerative back disease is apparent in most statistics on morbidity, lost workdays, and premature retirement. It has been calculated that three-fourths of the world's population will have suffered from low back pain at some time in their working lives (Wickstrom, 1978). In the United States, low back pain is second only to the common cold as a cause of time lost from work (Williams and Ward, 1983).

A national study to determine the vocational rehabilitation needs of disabled migrant and seasonal farmworkers (Cortés, 1974) found that the disability rate for farmworkers was three times that of the general U.S. population (44.5% versus 10.7%). Thirty-seven percent (37%) of the respondents in the 209 households surveyed had severe backaches or pain in the back or spine, while 27% reported pains, aches or swelling in other parts of the body. The respondents attributed their symptoms and impairments to a range of causes, many of them musculoskeletal in nature: accidents, injuries and falls (14%); arthritis, rheumatism, bursitis, neuritis (12%); breaks, strains, sprains or dislocation of ribs or joints, or cracked ribs (1%); other general or vague references to musculoskeletal or nervous disorders (e.g., "bad back," "my legs hurt") (10%). This study concluded that the multiple conditions and the high proportion of causes in the "musculoskeletal and nervous system" category suggested the cumulative effects of prolonged, demanding manual labor.

The degenerative musculoskeletal changes associated with heavy physical labor are of particular concern considering the fact that children also do farmwork. What are the short- and long-term effects of these mechanical stresses on the rapidly changing musculoskeletal system of children? Little is reported in the occupational health literature. A medical team commissioned to study farmworker health conditions in Florida and Texas in 1970 reported that undiagnosed back, hip, and lower-extremity pain was a common symptom in the young patients they saw. Symptomatically this pain resembled that of degenerative osteoarthritis, and degenerative osteoarthritis of the hips, knees, and hands was in fact common among older farmworkers. Multiple back deformities were seen, including scoliosis and kyphosis (hunchback). These conditions were occasionally due to injury, but many cases were not (U.S. Senate, 1970).

Juvenile disc disturbances are common in boys in their teens. The advanced disc changes in the dorsal and lumbar spine result in a round back, forward head posture, and a spine out of alignment. This condition tends to be aggravated by activities that involve stooping, lifting, and carrying (Jamieson, 1969).

Clinicians should realize that migrant farmworker patients may not be able to comply with standard palliative treatments, such as hot baths or use of a heating pad because of the limitations of their living quarters (Marohn, 1981).

Migrant Health Data

Data presented in chapter V include information on musculoskeletal problems of migrant farmworkers:

(1) The leading health condition, which affected 20-25% of migrant patients in an upstate New York study, was musculoskeletal problems (State University of New York at Buffalo, 1984).
(2) A survey of Florida migrant farmworkers showed that musculoskeletal problems were among both the most frequently reported acute as well as chronic conditions (Bleiweis et al., 1977).
(3) Back pain and vertebral sprain/strain were two of the twenty most frequently reported conditions among male migrant farmworkers in Michigan (Sparta Health Center, 1979).
(4) A survey of migrant farmworkers in Wisconsin showed that over one-fourth of those surveyed suffered backaches. Musculoskeletal or orthopedic problems were the second most frequent complaint among those who sought medical care. (Slesinger and Cautley, 1981).

Prevention of Musculoskeletal Problems

Proper design of work surfaces, tools, and equipment can reduce work strain and alleviate many of these problems (Williams and Ward, 1983). Introduction or elimination of some tools or practices may also help. For example, the incidence of sprains or strains (including of the back) among agricultural workers decreased 34% over the period 1965-1970 in California following the decline in use of the short-handled hoe. Likewise, injuries involving ladders decreased 40%; this was particularly evident in the lemon-producing areas where the trees were kept trimmed to a height that made ladders unnecessary. During this same time period, fruit and nut tree workers experienced a 19% decrease in sprain or strain injuries, most probably because of an increased use of mechanical harvesters and tree trimmers (Whiting, 1975). Thus, well-designed machinery is a mixed blessing for the farmworker: risk of injury may decrease, but fewer workers may be needed to do the work.

Payment of farmworkers by piece rate is another factor to consider when assessing how to prevent musculoskeletal problems. Prolonged periods of stressful posture with few breaks in order to earn a higher daily wage contribute to back strain. In addition, an excessively fast work pace has been cited as a risk factor for back strain (Wickstrom, 1978).

REFERENCES CITED

Andersson, G.B.J.: Epidemiologic Aspects on Low-Back Pain in Industry. *Spine* 6(1):53-60, 1981.

Bleiweis, P.R., Reynolds, R.C., Cohen, L.D. and Butler, N.A.: Health Care Characteristics of Migrant Agricultural Workers in Three North Florida Counties. *Journal of Community Health* 3(1):32-43, 1977.

Brown, J.R.: Lifting as an Industrial Hazard. *American Industrial Hygiene Association Journal* 34:292-297, July 1973.

Cortés, M.D.: *Handicapped Migrant Farm Workers: Characteristics of Disabled Migratory and Seasonal Agricultural Workers and Their Families, Impact of the State/Federal Vocational Rehabilitation Program, and Strategies for Expanding Services*. Washington, D.C.: U.S. Department of Health, Education and Welfare, DHEW Publication No. (OHD) 75-25084, December 31, 1974.

Coye, M.J.: The Health Effects of Agricultural Production: I. The Health of Agricultural Workers. *Journal of Public Health Policy* 6(3):349-370, 1985.

Jamieson, E.S.: Orthopaedic Problems Arising from Farm Work. *Annals of Occupational Hygiene* 12:87-93, 1969.

Jurmain, R.D.: Stress and the Etiology of Osteoarthritis. *American Journal of Physical Anthropology* 46:353-366, 1977.

Kelsey, J.L.: *Epidemiology of Musculoskeletal Disorders*. Monographs in Epidemiology and Biostatistics Vol. 3. New York: Oxford University Press, 1982.

Lawrence, J.S.: Rheumatism in cotton operatives. *British Journal of Industrial Medicine* 18:270-276, 1961.

Maeda, K., Okazaki, F., Suenaga, T. et al.: Low Back Pain Related to Bowing Posture of Greenhouse Farmers. *Journal of Human Ergology* 9:117-123, 1980.

Marohn, L.A.: Musculoskeletal Problems of Migrant Agricultural Laborers. Unpublished paper, May 8, 1981. Contact: L. Alfonse Marohn, D.O., Associate Professor, Department of Family Medicine, College of Osteopathic Medicine, Michigan State University, East Lansing, MI 48824.

New York Times: Use of Short Hoe on Farms Is Debated in Arizona. March 26, 1984.

Ortiz, A.: Telephone conversation on March 27, 1984 with Augusto Ortiz, M.D., Medical Director of the Arizona Rural Health Office, University of Arizona, 3131 E. Second St., Tucson, AZ 85716 (phone: 602-626-7946).

Parker, H.H., III. and Hemingway, D.C.: *Crewleader Violence Against Farmworkers in North Carolina*. A Report Prepared for the North Carolina Chapter of the National Lawyers Guild, 1981.

Partridge, R.E.H. and Duthie, J.J.R.: Rheumatism in Dockers and Civil Servants: Comparison of Heavy Manual and Sedentary Workers. *Annals of the Rheumatic Diseases* 27:559-567, 1968.

Slesinger, D.P. and Cautley, E.: Medical Utilization Patterns of Hispanic Migrant Farmworkers in Wisconsin. *Public Health Reports* 96(3):255-263, 1981.

Sparta Health Center: A Study of the Medical Conditions and Supplementary Health Conditions of Migrant Farmworkers. Unpublished data, 1979. For more information, contact: Ms. Kirsten Lundeen, Project Officer, Division of Health Care Systems, Department of Public Health, 3500 N. Logan, P.O. Box 30035, Lansing, MI 48909.

State University of New York at Buffalo: *The Health Care Needs and Economic Impact of Migrant Farmworkers: The Oak Orchard Service Area*. A *Descriptive Profile and an Assessment*. February, 1984. Available from: Oak Orchard Community Health Center, 80 West Avenue, Brockport, NY 14420.

U.S. Commission on Civil Rights: *The Working and Living Conditions of Mushroom Workers*. July 1977.

U.S. Senate: *Migrant and Seasonal Farmworker Powerlessness. Hearings Before the Subcommittee on Migratory Labor of the Committee on Labor and Public Welfare*. Ninety-first Congress. First and Second Sessions on Who is Responsible. Part 8-A, July 20, 1970. Washington, D.C.: U.S. Government Printing Office, 1970, pp. 5074-5077.

Whiting, W.B.: Occupational Illnesses and Injuries of California Agriculture Workers. *Journal of Occupational Medicine* 17(3): 177-181, 1975.

Wickstrom, G.: Effect of work on degenerative back disease: A review. *Scandinavian Journal of the Work Environment and Health* 4(suppl.1):1-12, 1978.

Williams, H.J. and Ward, J.R.: Musculoskeletal Occupational Syndromes. In: *Environmental and Occupational Medicine* (W.N. Rom, ed.). Boston: Little, Brown and Company, 1983, pp. 351-357.

XIV. Accidents

Agriculture is the second most dangerous occupation in the United States today. Migrant and seasonal farmworkers are susceptible to accidents from a variety of sources, although actual documentation of farmworker accidents is not easy. National and state accident data do not identify migrant and seasonal farmworkers in the agricultural categories. Generally, cause of accident and exact occupation of the worker are not specified. Worker's compensation does not cover agricultural workers in 20 states and, thus, agricultural injury and illness data may not even be compiled.

Worker fatigue increases the risk of accidents. Sources of fatigue among farmworkers include the heat and sun, long workdays with few rest periods, excessive noise, vibration, and poor posture caused by prolonged stooping, forward bending, etc.

Children work or play in the fields and thus are exposed to the same occupational hazards as adults. They also are more susceptible to pesticide poisoning accidents.

Prevention of farm accidents depends on engineering controls such as improved equipment design, monitoring the workplace for hazards and eliminating them or reducing their risk, farmworker safety training, and protective gear.

At this time, agriculture (including fishing and forestry) is the second most dangerous occupation in the United States. In 1983, there were an estimated 1800 work-related deaths and 180,000 disabling injuries among agricultural workers aged 14 and over. Only mining ranked as more dangerous (a mortality rate of 55 per 100,000 workers versus 52 per 100,000 for agriculture) (National Safety Council, 1984).

The U.S. farmworker population is exposed to numerous accident hazards because of the wide range of tasks performed on many different crops. Some types of farmworker occupational accidents have already been described, for example, pesticide poisoning by direct spraying or from drift; fractures or sprains from falls from ladders or equipment; sprains or strains from prolonged stooping or heavy lifting and carrying; amputations and lacerations from getting caught in machinery (such as the power take-off shaft); bones and joints crushed by tractor or truck accidents; eye injuries from pesticides or flying objects that puncture the eye; and heat stroke.

To this list can be added electrical accidents (e.g., electrocution from hitting a power line with farm equipment), carbon monoxide poisoning from running equipment in enclosed areas, drownings in irrigation ditches, and gashes and wounds from knives or machetes used in harvesting such crops as sugar cane. The injury rate for cane cutters is high: 1974 U.S. data on Florida cane cutters showed that due to job-related injuries, one hour of work was lost for every 53 hours worked. Data on the injury rates of West Indian cutters in the United States revealed that approximately one of every three workers was injured during the 1981-82 season (2,993/8,186), and almost half of the workers were hurt during the 1979-80 and 1980-81 seasons. (U.S. House of Representatives, 1983).

A number of factors contribute to worker fatigue, which increases the risk of accident, including noise from machinery, vibration, stooped posture, heat and sun, long workdays, few rest periods, and monotonous work.

The syllabus for a course on migrant farmworker health, developed in Washington state, describes the range of "accident susceptibility" migrants experience there:

> The season begins in early spring with pruning, thinning, and the use of tractors and spraying. For pruning, people use "apes" (a tractor with a long caged arm in which a person works). Falling injuries are frequently seen during the pruning & thinning process. Recently there has been a pneumatic saw used which is driven by a compressor. This saw creates problems for others around the user, not necessarily the user. It has a 3"-diameter open blade. While in use, those who are underneath and around the pruner may become injured and receive serious cuts.
>
> After the pruning is the asparagus harvest in early spring. During the asparagus harvest migrants who have been out of work for the winter must stoop over and cut the young asparagus. This leads to back injuries which last throughout the remainder of the summer. There are also lacerations from the knives used. The long work days lead to fatigue and carelessness with the knives. Also, pesticides which are used on the asparagus get into the lacerations and lead to poor healing and contact dermatitis.
>
> After the asparagus is harvested, people begin to work on the hops. Creosote is a wood preservative used in the growing structures for the hops. People have fallen into these vats and gotten overdoses of creosote. The first thing that happens with the hop harvest is the stringing of hops. In order to string hops one person must ride the tractor on a platform which is approximately 5 feet wide. The other person drives the tractor through the rows while the first person is stringing. The "stringer" twines the wire from the top to the ground, a total height of 10 feet. The height is very unstable, and the platform can tip, leading to severe injuries or even death. The hops are trained to follow twine, and the hop vine is a very rough vine, causing abrasions on the hands and leading to dermatitis. Related to the hop crop are the fertilizers which are generally dumped into the irrigation water. Open skin from the abrasions from handling rough vine get irritated by the fertilizer plus the pesticides and fungicides which may be on the ground from previous use.
>
> During the hop harvest machetes are used to cut the hops. The long trains of hops are then laid over a trailer which carries the hop trains from the fields to the buildings where they are put on hangers. In order to do this the migrant people work in teams which work very well

> together; however, a new member on the team or a very fatigued member adds to the number of accidents. The trailers are brought in and people hang the hop vines on a conveyor. On this conveyor the hop vines are then processed through a kiln for drying. The plants are dried and baled and also chopped more. The injuries involved in this process of harvesting include falls from the trailer, cuts from the machetes, and heat exhaustion from working near the kiln which dries the hops. The conveyors also emit carbon monoxide, which if not properly exhausted can lead to carbon monoxide poisoning.
>
> During the hop harvest the workers take advantage of the availability of the long hours for work. The hop harvest continues 24 hours a day. The fatigue of working 16 or 17 hours of those 24-hour days adds to the incidence of injury during this time.
>
> During the potato harvest people are at risk of back injuries due to the stooping position of the digger, as well as injuries from the use of the digger itself.
>
> The fruits which are harvested from August through September carry risk of ladder injuries, which are the primary injuries seen then (Yakima Valley Community College, 1980).

Children in the fields are subject to these same hazards. They are even more susceptible than adults to pesticide poisoning. They can be run over by farm machinery. Children can suffer heat stroke or heat exhaustion if they are left unattended in cars while the parents work in the fields. They also run the risk of accidents when left unattended in the labor camps.

The seriousness of traumatic injury is compounded in rural areas where distances to hospital emergency services are greater. In addition to the increased time it takes to reach medical care, there is also the period from the time when a solitary worker has an accident to when he or she is finally discovered. This latter time factor is not so likely to be a problem for crews of workers in the same field as it is for equipment operators working unaided such as tractor drivers who might have rollover accidents.

The major cause of work-related death in the United States is highway motor-vehicle accidents, including those involved going to and from work and job-related travel (Centers for Disease Control, 1984). Motor vehicle accidents are also a major occupational hazard for farmworkers. In 1971, for example, such accidents were the leading cause of accidental death among agricultural workers in California (Whiting, 1975).

National Data

Various sources report national accident data, including: the National Electronic Injury Surveillance System (NEISS) of the Consumer Product Safety Commission; the Supplementary Data System (SDS) of the Bureau of Labor Statistics (BLS) in collaboration with the Occupational Safety and Health Administration (OSHA), the Annual Survey of Occupational Injuries and Illnesses conducted by the BLS; and the National Safety Council. The National Safety Council and the Annual Survey of the BLS estimate occupational traumatic deaths.

These sources report different aspects of the problem of work-related trauma. The NEISS data comes from a representative sample of U.S. hospital emergency rooms. SDS reports information taken from workers' compensation claims filed in 33 states. The BLS Annual Survey reports traumatic events in the private sector; it does not, however, include data in the public sector, in firms regulated by other federal health and safety laws, nor on farms with ten employees or less. The National Safety Council reports data from the National Health Survey (based on 41,000 annual interviews with heads of households) and data from several participating public and private organizations. The definition of "recordable injury" varies considerably among these systems (Centers for Disease Control, 1984).

It is difficult to determine the extent and types of accidents among migrant and seasonal farmworkers from these sources.

The annual BLS survey is summary data; no information is obtained on occupation, age, sex, or race of the injured or ill worker nor on the characteristics of the injury or illness. The data do not supply any information on the causes of accidents resulting in injury or illness to the worker. In addition, chronic illnesses resulting from occupational injury are undercounted because of the difficulties in recognizing and diagnosing occupational disease. Disabling conditions caused by long-term occupational exposures such as hearing loss due to noise levels or chronic dermatitis due to pesticides are virtually excluded from the scope of the annual survey. Finally, the survey data do not include farms employing ten workers or less. It is estimated that about 85% of the migrant and seasonal farmworkers in the United States work on these small farms (Migrant Legal Action Program, Inc. and the Farmworker Justice Fund, Inc., 1984).

The Supplementary Data System (SDS) does include occupation, sex, nature of injury or illness, part(s) of the body affected, source of injury or illness, and accident type. Some states also report the extent of disability, the amount of medical costs, the age of the worker, and other variables. Although the SDS information does not exclude small farms, only 14 states plus Puerto Rico have complete workers' compensation coverage for agricultural workers. Sixteen states have partial coverage (Texas and North Carolina only as of 1984), and 20 states do not provide any coverage at all for agricultural workers. In states where farmworkers are not covered by workers' compensation, physicians have no incentive to report work-related injuries or illnesses, and are particularly unlikely to report occupational illness among field workers (Coye, 1985). Thus, agricultural injuries or illnesses among farmworkers are under-reported in this system too. In addition, because of the differences in state workers' compensation laws (coverage, reporting requirements, etc.) and participation of fewer than all states in the program, based on the SDS, national estimates of any kind cannot be drawn directly (Bureau of Labor Statistics, 1984).

The National Safety Council data, in contrast, do not have the limitations of the Department of Labor reporting systems. These data are largely from the National Health survey, a survey of households conducted by the National Center for Health Statistics. Once again, however, the exact number of migrant and seasonal farmworkers surveyed is not known. Farm data are broken down into only two categories: "farmers and farm managers" and "farm laborers and farm foremen."

Table 44 presents 1980 Supplementary Data System information from 16 states for wage earning farm laborers according to type of accident or exposure that involved a disability. Although these categories are broad and do not specify the exact causes of accidents, this table seems to indicate that over 70% of the accidents involved machinery or objects propelled by machinery, falls, and lifting and carrying loads. Table 45 provides additional information on these same 19,332 disabling incidents according to the source of the injury or illness (e.g., boxes, barrels, and containers were the source of injury in 10% of the cases). Cause of accident in these cases could have been overexertion, being struck by a box, or falling while carrying or lifting a box. Likewise, injuries or illnesses involving working surfaces (17% of cases) could include falls or contact with plants or branches.

TABLE 44
TYPE OF ACCIDENT OR EXPOSURE AMONG WAGE-EARNING FARM LABORERS: CASES INVOLVING DISABILITY
16 STATES, 1980*

Type of Accident or Exposure	*Number of Cases*	*Percent*
Struck by or struck against	5,996	31.0
Overexertion	3,949	20.4
Fall	3,942	20.4
Caught in or between	1,430	7.4
Bodily reaction	1,406	7.3
Contact with radiations, caustics, etc.	993	5.1
Rubbed or abraded	481	2.5
Motor vehicle accident	289	1.5
Contact with temperature extremes	240	1.2
All other classifiable	225	1.2
Nonclassifiable	381	2.0
TOTAL	19,332	100.0

*Data from Alaska (1), Arizona (8), California (1), Colorado (4), Indiana (1), Iowa (4), Kentucky (2), Maryland (4), Michigan (7), Minnesota (3), Mississippi (6), New Jersey (1), New Mexico (8), Oregon (4), Tennessee (8), and Wisconsin (4). The minimum number of days of disability before a report of a case is included in the Supplementary Data System is indicated in the parenthesis after each state. (Data taken from SDS Table 304. Available from the Bureau of Labor Statistics, Bldg. P.H., Room 4014, Washington, D.C. 20212.)

TABLE 45
SOURCE OF INJURY OF ILLNESS AMONG WAGE-EARNING FARM LABORERS: CASES INVOLVING DISABILITY
16 STATES, 1980*

Source of Injury or Illness	*Number of Cases*	*Percent*
Working surfaces	3,402	17.6
Boxes, barrels, containers	1,939	10.0
Hand tools	1,941	10.0
Vehicles	1,758	9.1
Metal items	1,519	7.9
Chemicals	473	2.4
Wood items	454	2.3
All other classifiable	6,105	31.6
Nonclassifiable	515	2.7
TOTAL	19,332	100.0

*Data from Alaska (1), Arizona (8), California (1), Colorado (4), Indiana (1), Iowa (4), Kentucky (2), Maryland (4), Michigan (7), Minnesota (3), Mississippi (6), New Jersey (1), New Mexico (8), Oregon (4), Tennessee (8), and Wisconsin (4). The minimum number of days of disability before a report of a case is included in the Supplementary Data System is indicated in the parenthesis after each state. (Data taken from SDS Table 303. Available from the Bureau of Labor Statistics, Bldg. P.H., Room 4014, Washington, D.C. 20212.)

State Data

Statistics on work-related injuries and illness by industry are compiled by the states through their workers' compensation claims. In states where agricultural workers are not covered, this source of information may not be available. The National Safety Council does, however, conduct an employer survey each year in which one state in each region of the country is selected for study. Each year different states are chosen and a 3% sample of farms is surveyed (Hanford, 1984).

The California Department of Industrial Relations reports on agricultural injuries and illnesses are especially valuable because they describe the occupations of the victims and the circumstances of many of the accidents.

Data on employees on vegetable and melon farms for 1982 (California Department of Industrial Relations, 1984) showed the following:

(1) Strains and sprains accounted for 40% (890) of the 2,198 disabling injuries and illnesses among these workers; cuts and punctures accounted for 18% (394) and contusions and crushing injuries for 11% (234) of the accidents.

(2) About 70% of the accidents involved either the back and spine (23%), the arms (28%), or the legs (18%).

(3) One-third of the workers were injured in "struck by or striking against" accidents. These could involve falls, hand tools, or other equipment.

(4) Overexertion was the second most common type of accident, accounting for 630 or 28% of the accidents.

A study of the death rates of white male farm laborers compared with farm operators for the period 1959-1961 in California (Carlson and Peterson, 1978) showed that farm laborers compared to farm operators had significantly higher rates of death from accidents and violence (twice as high); motor vehicle accidents (over two times as high); other accidents, including on-the-job accidents (three times as high); and respiratory disease (over three times as high).

In another California study, Stubbs et al. (1984) examined death certificate data of 7,476 farmworkers and 7,395 farm owner/managers who died in the state during 1978 or 1979, comparing the relative importance of the various causes of death using a proportionate mortality analysis. The study revealed that deaths of farmworkers due to all accidents and deaths related to motor vehicle accidents were consistently high for all race and sex categories and were significantly elevated ($p<0.05$) for white males, white females, and nonwhite males. The 565 deaths due to motor vehicle accidents, including deaths due to farming accidents involving motor vehicles, comprised about two-thirds of the deaths in the "all accident" category.

California is the only state that supplements its accident data with a mandatory reporting system of pesticide-related injury and illness. These data are gathered by the Worker Health and Safety Unit of the Department of Food and Agriculture, some of which were discussed in chapter X on pesticides.

Accident Prevention

The prevention of severe occupational traumatic injuries rests on the basic principles of controlling risks — engineering controls, safe work practices, personal protective gear, and monitoring of the workplace for emerging hazards. Specific measures to prevent accidents include: providing physical barriers between the farmworker and moving machine parts such as a machine guard for the power takeoff shaft; making changes in the design of tools (e.g., knives and saws) and tasks to reduce work hazards; training farmworkers in the safe performance of tasks; repeatedly and systematically inspecting the workplace for emerging or previously undetected hazards; and using protective gear such as respirators, goggles, and impermeable clothing to protect against pesticide residues (Centers for Disease Control, 1984). (As with other industries, such protective gear should be provided by the employer.) A continuous commitment to safety by both management and labor is necessary if we are to prevent serious occupational accidents.

Most farmworkers do not have health insurance. Agricultural workers receive complete coverage by workers' compensation in only 14 states plus Puerto Rico. They are partially covered in 16 states and not covered at all in 20 states. Increasing coverage of these programs is clearly necessary. Not only do accidents put a financial strain on the farmworker family in the short run, but a severe injury may permanently disable a worker or even prove fatal.

REFERENCES CITED

Bureau of Labor Statistics: Occupational Injury and Illness Statistics Program of the Bureau of Labor Statistics. March 1984. Paper available from: Bureau of Labor Statistics, Building P.H. Room 4014, Washington, D.C. 20212.

Bureau of Labor Statistics: SDS Table 303. Source of Injury or Illness: Number and Percent Distribution of Cases, by Occupation, All Workers. Cases Involving Disability. 16 States, 1980. Available from the Bureau of Labor Statistics, Bldg. P.H., Room 4014, Washington, D.C. 20212.

Bureau of Labor Statistics: SDS Table 304. Type of Accident or Exposure: Number and Percent Distribution of Cases, by Occupation, All Workers. Cases Involving Disability. 16 States, 1980. Available from the Bureau of Labor Statistics, Bldg. P.H., Room 4014, Washington, D.C. 20212.

California Department of Industrial Relations: Disabling Work Injuries and Illnesses to Employees of Vegetable and Melon Farms, by Major Accident Factors. California, 1982. January 1984. Available from: Division of Labor Statistics and Research, P.O. Box 603, San Francisco, CA 94101.

Carlson, M.L. and Petersen, G.R.: Mortality of California Agricultural Workers. *Journal of Occupational Medicine* 20(1):30-32, 1978.

Centers for Disease Control: Leading Work-Related Diseases and Injuries — United States. *Morbidity and Mortality Weekly Report* 33(16):213-215, April 27, 1984.

Coye, M.J.: The Health Effects of Agricultural Production: I. The Health of Agricultural Workers. *Journal of Public Health Policy* 6(3):349-370, 1985.

Hanford, W.D.: Telephone conversation of December 12, 1984 with Mr. William D. Hanford, Manager, Agricultural Department, National Safety Council. The Council's Farm Department has published a series of farm safety bulletins which cost between 14-26 cents. Their publication list can be obtained from: National Safety Council, 444 N. Michigan Avenue, Chicago, IL 60611 (phone: 312-527-4800).

Migrant Legal Action Program, Inc. and the Farmworker Justice Fund, Inc.: *Post Hearing Proposed Findings of Fact and Conclusions of Law*. Brief filed with the U.S. Department of Labor Occupational Safety and Health Administration, proposed farmworker field sanitation standard (Docket No. H-308). Available for $6.00 from the Farmworker Justice Fund, Inc., 2001 "S" St., N.W., Suite 312, Washington, D.C. 20009 (phone: 202-462-8192).

National Safety Council: *Accident Facts, 1984*. Available from the National Safety Council, 444 N. Michigan Avenue, Chicago, IL 60611 (312-527-4800) for $11.25.

Stubbs, H.A., Harris, J., and Spear, R.C.: A Proportionate Mortality Analysis of California Agricultural Workers, 1978-79. *American Journal of Industrial Medicine* 6:305-320, 1984.

U.S. House of Representatives: *Job Rights of Domestic Workers: The Florida Sugar Cane Industry*. Prepared by the Subcommittee on Labor Standards of the Committee on Education and Labor, July 1983. Washington, D.C.: U.S. Government Printing Office, 1983, p. 15.

Whiting, W.B.: Occupational Illnesses and Injuries of California Agriculture Workers. *Journal of Occupational Medicine* 17(3):177-181, 1975.

Yakima Valley Community College: *Migrant Health Course: A Syllabus*. Presented by the Community Health Advocate Program in collaboration with the University of Washington School of Public Health and Community Medicine, Summer 1981. For copies contact: Maria C. Gardipee, Walla Walla Community Health Clinic, 208 N. Second Avenue, P.O. Box 177, Walla Walla, WA 99363 (phone: 509-525-6650).

XV. Noninfectious Respiratory Conditions

Farmworkers are exposed to many substances that are hazardous to the respiratory system. Allergy-producing agents include grain dusts, pollens, animal dander, fertilizers, pesticides, fungi, and bacteria. Allergens may lead to hay fever, asthma, chronic bronchitis, or more serious conditions like hypersensitivity pneumonitis (e.g., farmer's lung, mushroom worker's lung).

Aflatoxins, toxins produced by molds such as *A. flavus*, are most commonly found in the United States in peanuts, cottonseed, and corn grown in the South. Inhalation as well as ingestion of aflatoxins have been linked to liver and colon cancer in humans. Animal studies have shown them to be mutagens, teratogens, carcinogens, and immunosuppressants.

Inhalation, ingestion, or dermal absorption of pesticides such as the herbicide paraquat can result in pulmonary fibrosis.

Dust exposure can cause lung damage to pickers. High levels of respirable dust that exceed allowable levels in industry and the presence of silica (quartz) and other mineral particles in the aerosols lead to nodular fibrotic changes in the lungs. In addition, silica in the lungs increases susceptibility to tuberculosis. This is of special concern to migrant farmworkers who often live in overcrowded and unsanitary conditions and who experience high rates of tuberculosis.

Farmworkers inhale a variety of substances at the worksite that can lead to respiratory problems. These substances include dusts, pollens, molds, spores, fungi, animal dander, and pesticides. In addition, overcrowded living conditions and unsanitary workplace practices such as use of a common drinking cup contribute to the spread of colds and upper respiratory tract infections.

When an injurious substance enters the lung, several outcomes are possible: the lung may restore itself to normal (resolution); there may be permanent scarring or alteration of the function of the lung; or a tumor may form (neoplasia). Scarring is thought to be a predisposing cause or cofactor in the later development of tumors or cancer (Abraham, 1982). Cigarette smoking is not only a direct carcinogen but can also have synergistic effects in conjunction with occupational exposures such as asbestos or cotton dust and produces lung cancer and progressive airway obstruction (Kilburn, 1984).

Asthma, chronic bronchitis (particularly that involving dyspnea and presumably due to obstruction or obliteration of small airways), influenza and pneumonia, emphysema, and fibrosis account for most early retirements due to pulmonary impairment. These ailments lead to many deaths, not only those directly attributed to these diseases, but also because the four chronic disorders contribute materially to deaths from pneumonia and influenza; the host encumbered with such chronic conditions is particularly vulnerable to viruses and bacteria. Small airways, the terminal bronchioles, are the most vulnerable parts of the airway. Spread of disease to these small airways accounts for the progressive deterioration in lung function (Kilburn, 1984).

Parasitic infections also can compromise the respiratory system: worms rupture the alveoli, making the lungs a fertile breeding ground for infectious agents such as bacteria and viruses.

In this chapter, we deal with three major types of occupationally caused noninfectious respiratory conditions that afflict agricultural workers:

(1) Allergic conditions, including rhinitis, asthma, chronic bronchitis, and hypersensitivity pneumonitis (e.g., farmer's lung, mushroom worker's lung),
(2) Pesticide lung, and
(3) Silicate pneumoconiosis.

Allergic Conditions

The agricultural environment contains a wide range of substances that can produce hypersensitivity (allergens) in humans including animal dander and bird feathers; grain dusts such as wheat, barley, and oat dust, which contain not only grain allergens but also mold spores, bacteria, insects such as mites and their parts, rodent hair, excreta from rodents and insects, pollen, and chemicals that also produce allergies; antibiotics; fertilizers; pesticides; livestock and poultry feed; and insect stings.

An allergic reaction in the nose is called allergic rhinitis or hay fever, the symptoms of which include runny nose and sneezing, sometimes accompanied by itchy nose and throat. Asthma is caused by an allergic reaction of the airways of the lung; it is characterized by coughing, wheezing, and shortness of breath that often occur in the form of "attacks" (Levy, 1982). Asthma and rhinitis are responses to allergens entering the bronchial tree and upper respiratory tract. These reactions affect the 10% of the population who have hyperreactive airways or high levels of circulating reaginic (IgE) antibodies (Jones, 1982). Thus, there may be up to 500,000 or more farmworkers who have significant symptoms due to allergic disease (Levy, 1982).

There are innumerable examples of agricultural workplace exposures to allergens: hay fever is a response to allergens such as pollen and mold spore exposure; asthma in poultry workers has been linked to the presence of mites and mite parts in poultry house dust (Lutsky and Bar-Sela, 1982); and sulfur and sulfates, used as fungicides, can cause asthma (Levy, 1982).

Grain dusts can cause rhinitis, asthma, or chronic bronchitis because of the wide range of allergens they contain. In a small undefined portion of those exposed, repeated grain dust exposure leads to a more serious condition known as hypersensitivity pneumonitis or farmer's lung, which develops in the peripheral tissues of the lung and is a permanent condition.

The acute symptoms of farmer's lung disease and all the other hypersensitivity pneumonitis disorders occur four to eight hours after a heavy exposure to the dust. Symptoms include fever accompanied by sweating and chills, a troublesome but often unproductive cough, shortness of breath, and more generalized feelings of malaise, as well as muscle and joint aches. Following an acute episode, such symptoms may subside within 48 hours or may persist for several weeks. Changes in x-rays appear within days of the episode and show a net-like, nodular pattern of infiltrates throughout the lower two-thirds of the lung fields. Where subacute exposure is frequently repeated onset is more insidious. The chronic disease is characterized by progressively increasing dyspnea, chronic cough, weakness, anorexia, and weight loss. The x-rays show a range of abnormalities, from the acute picture to deforming pulmonary fibrosis. The principal defects found are reduced lung volumes and impaired oxygen-diffusing capacity. In long-term sufferers, the disease may result in crippling respiratory insufficiency (Jones, 1982). The disease is not well-known to most physicians and is often mistaken for pneumonia or bronchitis (Wenzel et al., 1970).

Farmer's lung is a permanent condition; any further exposures to the offending dusts will aggravate the pathogenic processes in the lung. The recurrence of symptoms and the progression of lung damage is not simply a reflection of the intensity of exposure, but is, moreover, a reflection of the particular individual's sensitivity. In this respect, therefore, there is probably no threshold level dividing safe from hazardous conditions for the patient who has developed hypersensitivity pneumonitis (Jones, 1982).

In 1959, a type of hypersensitivity pneumonitis among mushroom workers was reported for the first time in the medical literature (Bringhurst et al., 1959). The affected Puerto Rican migrant farmworkers in Pennsylvania developed the following symptoms, with decreasing frequency: cough; rales; pain in the chest, stomach, or muscles; shortness of breath; yellow or greenish yellow sputum; nausea and vomiting; headache; chill; rapid weight loss; anorexia; sore throat; night sweats; malaise; diarrhea; spitting up blood; and nosebleeds. A combination of symptoms often suggesting tuberculosis was observed. The authors speculated that the condition (mushroom worker's lung) was caused by nitrogen dioxide gas from the hay and mold in new compost or from organic dust. Mushroom spores (*Pleurotus florida*) are another causative agent (Jones, 1982).

Toxins produced by molds such as *Aspergillus flavus* are called aflatoxins; they are a health hazard both to the general public who may eat contaminated foods and to agricultural workers who may breathe aflatoxins in the dusts generated by the handling of contaminated commodities. The effects of aflatoxins vary considerably in animal studies, depending on the type of animal used, the route of entry, the dose administered, and the duration of exposure. Studies have shown that the major effects associated with aflatoxins include acute liver damage, cirrhotic liver degeneration, induction of malignant tumors at several sites, teratogenesis, immunosuppression, and genetic damage. Among the aflatoxins, aflatoxin B_1 is the most toxic and carcinogenic; it is produced in the largest quantities by the fungi and, therefore, is probably of most concern in contaminated commodities. At least 17 aflatoxins have been described, but the ones most often found in cereal grains and oil seeds are aflatoxins B_1, B_2, G_1, and G_2. In the United States, the greatest incidence and highest levels have been found in peanuts, in cottonseed grown in southern Arizona and California, and in corn, mostly that grown in the South (Shotwell and Burg, 1982).

There have been several reports in the medical literature of humans exposed to aflatoxins who subsequently developed cancer. In one report, for instance, two agricultural researchers working with aflatoxin developed colon cancer. A study of 70 Dutch workers in a plant processing peanuts and flaxseed for their oils found that 11 workers developed an unusual variety of malignant tumors, and two died of liver diseases during the 11-year study period. The cancers included four cases of bronchial carcinoma as well as cancers of the liver, prostate, maxillary sinus, gastrointestinal tract, bladder, lymph nodes, and pleural mesothelioma (Shotwell and Burg, 1982).

Pesticide Lung

The acute toxicity of most pesticides is well-known; however, the chronic effects of pesticides on the respiratory tract are poorly documented.

A study of 132 Danish fruit-growers and farmers showed that those respondents who had used pesticides displayed a higher, though not statistically significant, frequency of symptoms (e.g., cough and expectoration, nasal discharge, breathlessness, headache) than those who did not have pesticide exposure (Lings, 1982). This study showed that pesticide lung consisted of pneumonia demonstrated on x-ray by more or less transient round infiltrations and chronic progressive lung fibrosis.

A South African study of ten farmworkers who had been dermally exposed to paraquat showed that low-dose skin absorption can cause potentially severe pulmonary vascular disease (Levin et al., 1979). These researchers observed pulmonary arterial lesions in both men and rats exposed to the chemical. While it had been recognized that ingestion of paraquat causes progressive proliferative changes in the lung that lead to respiratory failure and death, the importance of skin absorption in the development of lung disease had not been previously reported. It should be noted that cracks and abrasions of the skin, typical in farmworkers, increase the amount of absorption.

Silicate Pneumoconiosis

Research in California has shown that manual harvesters of citrus, grapes, and peaches are exposed to high levels of mineral dust, levels that are in excess of general industry standards and can have detrimental long-term effects on lung function. Respiratory hazards result not only from the very high levels of total aerosol, but also from the presence of quartz and other mineral constituents in respirable aerosols (Popendorf et al., 1982). Quartz or crystalline silica dust can produce silicosis, causing formation of nodular fibrotic changes in both lungs.

Of special concern to migrant farmworkers is the fact that lungs that contain silica are more susceptible to tuberculosis (Kilburn, 1984). Given the overcrowded and unsanitary living conditions of many migrants and the high prevalence of tuberculosis among the population groups from which migrants come (such as the south Texas border population) (Lyndon B. Johnson School of Public Affairs, 1979), mineral dust exposure may present a special occupational risk for migrant farmworkers.

A death certificate study of white male farm laborers compared to white male farm managers in California showed that farm laborers died of respiratory disease more than three times as often as did farm managers (Carlson and Petersen, 1978). These researchers cited the dry and dusty climate of California as well as the high use of pesticides as contributing factors to this increased mortality. Dust levels California farmworkers have been exposed to have been measured at two times the industry threshold limit value.

Prevention

Prevention of respiratory disorders must include technological improvements to eliminate or reduce farmworker exposure to harmful substances, development and enforcement of reentry intervals for farmworkers exposed to pesticides — especially those working in enclosed areas such as greenhouses, farmworker training on respiratory hazards in the workplace, and the use of protective clothing and equipment such as respirators where effective and appropriate.

A federal task force specifically recommended that agricultural workers be given special consideration in new studies of occupational respiratory disease (U.S. Department of Health, Education, and Welfare, 1977).

REFERENCES CITED

Abraham, J.: Pulmonary disease among farm workers. In: *Annals of the American Conference of Governmental Industrial Hygienists. Vol. 2: Agricultural Respiratory Hazards* (W.D. Kelley, ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists, 1982, pp. 93-99.

Bringhurst, L.S., Byrne, R.N., and Gershon-Cohen, J.: Respiratory Disease of Mushroom Workers. *Journal of the American Medical Association* 171(1):101-104, 1959.

Carlson, M.L. and Petersen, G.R.: Mortality of California Agricultural Workers. *Journal of Occupational Medicine* 20(1):30-32, 1978.

Jones, A.: Farmer's lung: an overview and prospectus. In: *Annals of the American Conference of Governmental Industrial Hygienists. Vol. 2: Agricultural Respiratory Hazards* (W.D. Kelley, ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists, 1982, pp. 171-182.

Kilburn, K.H.: Chronic Disease in the Workplace and the Environment. Lung Disease: Lessons from the Past — Keys to the Future. *Archives of Environmental Health* 39(3):139-143, 1984.

Levin, P.J., Klaff, L.J., Rose, A.G., et al.: Pulmonary effects of contact exposure to paraquat: a clinical and experimental study. *Thorax* 34:150-160, 1979.

Levy, D.A.: Allergic response and agricultural activities. In: *Annals of the American Conference of Governmental Industrial Hygienists. Vol. 2: Agricultural Respiratory Hazards* (W.D. Kelley, ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists, 1982, pp. 161-170.

Lings, S.: Pesticide lung: a pilot investigation of fruit-growers and farmers during the spraying season. *British Journal of Industrial Medicine* 39:370-376, 1982.

Lutsky, I. and Bar-Sela, S.: Northern Fowl Mite (*Ornithonyssus sylviarum*) in Occupational Asthma of Poultry Workers. *The Lancet*, October 16, 1982, pp. 874-875.

Lyndon B. Johnson School of Public Affairs: *The Health of Mexican-Americans in South Texas*. Policy Research Project No. 32. Austin, TX: The University of Texas at Austin, 1979.

Popendorf, W.J., Pryor, A., and Wenk, H.R.: Mineral dust in manual harvest operations. In: *Annals of the American Conference* of *Governmental Industrial Hygienists. Vol. 2: Agricultural Respiratory Hazards* (W.D. Kelley, ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists, 1982, pp. 101-115.

Shotwell, O.L. and Burg, W.R.: Aflatoxin in corn: potential hazard to agricultural workers. In: *Annals of the American Conference of Governmental Industrial Hygienists. Vol. 2: Agricultural Respiratory Hazards* (W.D. Kelley, ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists, 1982, pp. 69-85.

U.S. Department of Health, Education, and Welfare: *Human Health and the Environment — Some Research Needs*. Report of the Second Task Force for Research Planning in Environmental Health Science. DHEW Publication No. NIH 77-1277. Washington, D.C.: U.S. Government Printing Office, 1977.

Wenzel, F.J., Gray R.L. and Emanuel, D.A.: Farmer's Lung, Its Geographic Distribution. *Journal of Occupational Medicine* 12(12): 493-496, 1970.

XVI. Cancer

There is little data on cancer among migrant and seasonal farmworkers. Studies of stable farm populations have most consistently shown an increased risk of leukemia, but higher than expected death rates also have been reported for a variety of cancers including prostate, stomach, skin, lip, pancreatic, kidney, lymphatic, and blood (hematopoietic) system cancers. Researchers hypothesize that pesticide exposure may be responsible for the increased risk of cancers in those who work with crops. Viruses are implicated in cancers among poultry and dairy farmers. The sun, wind, and dust are responsible for the increased rates of skin and lip cancer, and several studies have linked pesticide exposure in children to increased rates of brain cancer and leukemia. More research is needed to document the cancer risk to the farmworker population — in both adults and children — especially because of the widespread use of child labor in agriculture.

There is little data on the types and rates of cancer among hired farm laborers in the United States. The mobility of the migrant farmworker population and the absence of a national medical tracking system for them have been two major obstacles standing in the way of such studies. In addition, there is no standard death certificate or standard approach to obtaining information on a person's usual occupation; neither are there standard ways of coding that information that would apply throughout the country. Thus, there are no reliable estimates of cancer mortality in farm laborers (Coye, 1985).

A retrospective case-control study to identify occupational risk factors associated with primary liver cancer in New Jersey (Stemhagen et al., 1983) found that male farmworkers were at almost twice the risk of developing liver cancer as was a nonfarm control population, a risk level that did not occur among farm owners and managers. The authors hypothesized that this statistically significant risk could be due to contact with agricultural chemicals.

A case-control study in Italy of patients with gliomas (tumors) of the central nervous system found that agricultural workers who did farmwork after 1960 had a two- to fivefold risk of suffering from this type of cancer (Musicco et al., 1982). (It was only after 1960 that Italy began heavy use of organic insecticides, herbicides, and fertilizers.) The authors recommended further research to study the association between pesticide exposure and brain tumors.

Of all cancers, leukemia is most consistently associated with farming. Elevated rates of leukemia among dairy and poultry farmers suggest involvement of zoonotic viruses, while associations with crop production point to pesticide exposure. Nonetheless, the specific leukemogenic agent or agents have yet to be identified (Blair, 1982). Burmeister et al. (1982) hypothesized that the increased number of deaths from leukemia among Iowa farmers might be due to the contamination of shallow farm wells and ponds by nitrogen fertilizer runoff. They also suggested that the nitrogenous waste of dairy animals, which produce much greater amounts of waste than other livestock, might be a factor. Since farmworkers often must use irrigation ditches or ponds as their source of water for drinking, cooking, and bathing, this theory has important implications for their health.

A mortality study in British Columbia, Canada of 28,032 male farmers who died between 1950-1978 showed significantly elevated risks of death from leukemia and lip, stomach, and prostate cancers over the 29-year period. The risk for aplastic anemia was also statistically significant; it was highest for the years 1950-1959 but declined during the rest of the period (Gallagher et al., 1984). In their discussion of the elevated risk of stomach cancer, the authors suggested a link between nitrogen fertilizers and thiocarbamate pesticides such as ziram and thiram, which can react with nitrates under acidic conditions to form carcinogenic N-nitroso compounds.

Other cancer studies have shown increased mortality among farmers due to a variety of cancers: prostate, stomach, skin, pancreatic, kidney, lip, laryngeal, pharyngeal, multiple myeloma, and other cancers of the lymphatic and hematopoietic (blood) systems (Blair, 1982; Flanders et al., 1984). According to Blair (1982), lung cancer among farmers occurs less than expected except among orchardists, possibly due to their exposure to arsenical pesticides. Farmers also are more often nonsmokers, which probably accounts for some, if not all, of this difference. The elevated risk of lip and skin cancer is attributed to the sun, wind, and dust exposure (Wiklund, 1983).

A mortality study of white male licensed pesticide applicators in Florida (Blair et al., 1983) showed excessive death rates from lung and brain cancers as well as leukemia. The risk of lung cancer was greatest (fivefold) for those applicators who had been licensed for the first time when they were under age 30 and whose job titles suggested direct pesticide exposure. Among applicators who were exposed to the chemicals, there was a significant decrease in risk of lung cancer in proportion to increased age at the time of initial licensing.

Several studies have linked pesticide exposure in children with increased rates of cancer. Gold et al. (1979) found that children with brain tumors were more likely to have lived on farms than children who had no known malignancies. Also, there was a greater tendency for the children with brain tumors to have had previously reported contact with insecticides as compared to healthy children. A Finnish study (Hemminki et al., 1981) found an association between childhood leukemia and parental occupation in farming.

Farmworkers are frequently exposed to pesticides and the sun, two of the occupational variables linked to cancer. More data on cancer and other chronic health conditions must be collected on this population. Given the widespread use of child labor in agriculture, rates of childhood cancers should also be of special concern.

REFERENCES CITED

Blair, A.: Cancer Risks Associated with Agriculture: Epidemiologic Evidence. In: *Genetic Toxicology: An Agricultural Perspective*. (R.A. Fleck and A. Hollaender, eds.). New York: Plenum Press, 1982, pp. 93-111.

Blair, A., Grauman, D.J., Lubin, J.H. and Fraumeni, J.F.: Lung Cancer and Other Causes of Death Among Licensed Pesticide Applicators. *Journal of the National Cancer Institute* 71(1):31-37, 1983.

Burmeister, L., Van Lier, S.F., and Isacson, P.: Leukemia and Farm Practices in Iowa. *American Journal of Epidemiology* 115(5):720-728, 1982.

Coye, M.J.: The Health Effects of Agricultural Production: I. The Health of Agricultural Workers. *Journal of Public Health Policy* 6(3):349-370, 1985.

Flanders, W.D., Cann, C.I., Rothman, K.J., et al.: Work-related Risk Factors for Laryngeal Cancer. *American Journal of Epidemiology* 119(1):23-32, 1984.

Gallagher, R.P., Threlfall, W.J., Spinelli, J.J., et al.: Occupational Mortality Patterns among British Columbia Farmworkers. *Journal of Occupational Medicine* 26(12): 906-908, 1984.

Gold, E., Gordis, L., Tonascia, J., et al.: Risk Factors for Brain Tumors in Children. *American Journal of Epidemiology* 109:309-319, 1979.

Hemminki, K., Saloniemi I., Salonen, T., et al.: Childhood cancer and parental occupation in Finland. *Journal of Epidemiology and Community Health* 35:11-15, 1981.

Musicco, M., Filippini, G., Bordo, B.M., et al.: Gliomas and Occupational Exposure to Carcinogens: Case-Control Study. *American Journal of Epidemiology* 116(5):782-790, 1982.

Stemhagen, A., Slade, J., Altman, R., et al.: Occupational Risk Factors and Liver Cancer. *American Journal of Epidemiology* 117(4):443-454, 1983.

Wiklund, K.: Swedish Agricultural Workers: A Group with a Decreased Risk of Cancer. *Cancer* 51:566-568, 1983.

XVII. Maternal And Child Health Hazards

Workplace exposures can adversely affect the male and female reproductive systems, fetal development, and children's health.

The nature of agricultural work and the physiological changes of pregnancy put the pregnant farmworker at increased risk of health problems for both herself and her baby. Occupationally caused fatigue has been associated with prematurity. Pesticides may cause genetic damage, miscarriage, cancer, birth defects, or adverse neurological or behavioral effects. The risk of heat stress is heightened during pregnancy, as is the risk of infection and respiratory problems. Musculoskeletal changes occur as the fetus grows and the woman's center of gravity changes, increasing the risk of falls. The lack of toilets in the fields increases the probability of urine retention, which leads to urinary tract infections, and urinary tract infections during pregnancy have been linked to higher rates of premature birth and perinatal deaths.

Workplace and non-workplace exposures may interact to increase susceptibility to harm (e.g., smoking, drugs, medical treatments). Genetic factors must also be considered in terms of an individual's inherent ability to detoxify contaminants or metabolize dangerous chemicals.

Child labor is an important element in agriculture. More research is needed to document the extent and the long-term effects of workplace illness and injury, including musculoskeletal problems, communicable diseases, accidents, acute pesticide poisoning and chronic effects of pesticide exposure, on migrant and seasonal farmworker children.

Reproductive Effects

Workplace conditions can have adverse effects on both the female and male reproductive systems. Some of these effects, such as sterility and menstrual dysfunction, have already been noted in chapter X with regard to pesticide exposure. Much, however, remains to be discovered about occupational factors and reproductive health. For example, many of the events related to fertility (e.g., ovum or sperm transport, sperm penetration, and the mechanism and site of implantation in the uterus) are poorly understood, particularly in regard to influences of the chemicals. The reproductive hazards to which women are exposed may precede fertilization, occur between fertilization and implantation, or during formation of the placenta and birth, at birth, postnatally, or through accelerated reproductive aging such as premature menopause (Schull, 1984).

This chapter will focus first on the health risks in the workplace for pregnant farmworkers and their newborn babies and then on work-related health risks for children. We should note that the effects of detrimental exposures during pregnancy or early infancy may not manifest themselves until later in childhood, in adolescence, or even later.

Physiological Changes During Pregnancy

Some workplace exposures are more dangerous during pregnancy not only because of the presence of the fetus (e.g., the possibility of transplacental transfer of fetotoxic or teratogenic substances), but also because of the physiological changes inherent in pregnancy. Pregnancy is characterized by progressively increasing blood volume, heart rate, stroke volume, and cardiac output, at least into the third trimester. As pregnancy advances women also experience a progressive decline in exercise tolerance and cardiac reserve (Wallace and Wilk, 1979).

For example, during pregnancy the concentration of red blood cells (and obviously hemoglobin) falls because the increase of plasma volume is, relatively speaking, greater than the increase of red cell volume. The lowest concentration in the gestational period is reached at about 34 weeks when the plasma volume is greatest. This phenomenon is often called the "physiological anemia of pregnancy" (Hunt, 1975). Chemicals such as organochlorine pesticides (DDT and its analogues such as chlordane and lindane), benzene, lead, and carbon monoxide also can cause anemia. The pregnant worker exposed to any of these substances is at greater risk of developing an anemia.

Respiratory function also undergoes some changes in pregnancy. Although vital capacity probably does not change, there is a marked rise in tidal volume (amount exhaled) throughout pregnancy. The respiratory rate rises very little, if at all, during pregnancy, which indicates that the pregnant woman breathes more deeply and not more frequently. The inhalation capacity increases at the expense of the expiratory reserve so that the lung is relatively more collapsed at the end of a normal exhalation. Residual air volume usually acts as a buffer to changes in anesthetic and normal respiratory gas tensions. The larger the volume of this residual air in the lungs, the more slowly the change occurs in gas concentration. Conversely, the pregnant woman with her small functional residual capacity will more readily and rapidly fill her lungs. Thus, the potential exists for increased exposure of the pregnant woman to contaminants, particularly those entering the body via the inhalation route (Hunt, 1975). Therefore, the pregnant farmworker is at increased risk of acute pesticide poisoning by inhalation due to the change in her lung function.

In addition, capillary enlargement occurs throughout the respiratory tract during pregnancy. This results in mucosal edema and increased blood supply in the nasopharynx and tracheobronchial tree, which cause voice changes and impaired nose-breathing. These symptoms may be aggravated by dusts, pollens, and airborne irritants (Wallace and Wilk, 1979). As described in chapter XV, farmworkers are exposed to a number of these respiratory irritants. Her increased respiratory vulnerability could put the pregnant farmworker at higher risk of developing other respiratory conditions. For example, excessive inhalation of the dusts of arsenical pesticides may cause bronchitis and pneumonia (Morgan, 1980). Female farmworkers who are already predisposed to hypersensitivity pneumonitis would be at even greater risk during pregnancy.

Pregnancy as a physiological stress may also trigger the appearance of a previously asymptomatic condition. For example, it was reported in a study of female beryllium workers that 40% of the women with chronic diseases who had become pregnant after beryllium exposure experienced symptoms of pneumonitis during their pregnancy. Another study of 95 women beryllium workers who had died from beryllium poisoning identified 66% (63) as having pregnancy as a precipitating factor. Beryllium disease was not immediately diagnosed in the children; however, follow-up on the growth and development of these offspring was needed (Hunt, 1975).

Another factor to consider in pregnancy is that musculoskeletal changes occur, which may increase the risk of falls and result in some loss of balance and lower back discomfort late in pregnancy. As the enlarging uterus moves the center of gravity backward in the lower portion of the spine and forward in the neck region, accentuated lumbar lordosis (swayback) and dorsal kyphosis (hunchback) occur. In addition, softening and extensibility of the abdominal musculature and pelvic ligaments occur, increasing their vulnerability to physical damage. Pregnant women should not work in areas where there is inadequate protection against slips and falls (Wallace and Wilk, 1979).

Pregnant farmworkers are at increased risk of musculoskeletal injuries with possible adverse effects not only to themselves but also to the fetus (e.g., miscarriage, prematurity) for several reasons:

(1) The overall accident rate in agriculture is high, and falls are a common type of agricultural accidents.
(2) Fatigued muscles are at increased risk of musculoskeletal injury; fatigue sets in more easily during pregnancy, especially during strenuous work.
(3) The ground over which farmworkers must walk is often uneven or may be wet and slippery. This adds to the possibility of falls and potential harm to the pregnant woman's protruding abdomen and the fetus.

Physical Risk Factors of Farmwork

Farmwork involves heavy physical labor, long workdays, lifting and bending, prolonged standing, and work in hot and dusty environments at worksites that often lack adequate, clean drinking water, toilets, and handwashing facilities.

A study of pregnant working women in France showed that the risk of prematurity increased with the number of sources of occupational fatigue (Mamelle et al., 1984). Some of these sources of occupational fatigue included: standing position for three or more hours, physical effort, load carrying, routine work, work on machines, very wet atmosphere, long daily commuting time, and repetitive, boring work that required little attention. The prematurity risk increased if the woman worked more than 40 hours a week, especially if she was subjected to intense occupational fatigue. When medical, social, and occupational factors all were analyzed, the only important and significant risk factors for prematurity were the fatigue index, previous history of premature births, and number of live births (parity); this latter risk factor decreased with increasing parity. In addition, a synergistic effect was found between the occupational and medical risk factors. The authors calculated that a woman who was pregnant with her first child and had a strenuous job ran an 11% risk of prematurity, while a pregnant woman who already had had a premature birth and worked at a strenuous job ran a 30% risk of another premature birth. Prematurity increases the risk of infant mortality (Werner et al., 1971).

The Ontario Perinatal Mortality Study 1960-1961, which included 51,490 births with 701 fetal deaths and 655 early neonatal deaths, showed that nonsedentary employment was associated with an increase in the prematurity rate. This higher perinatal mortality rate was only apparent when the nonsedentary employment took place in the first trimester (Hunt, 1975).

Research suggests that, for some women, the oxygen supply to the fetus decreases during exercise. Degree of physical conditioning of the woman is one factor: since mothers with a small heart or with diminished cardiac reserve due to mild heart diseases tend to have smaller babies, grading of the work load to physical conditioning may be useful, especially for those who have strenuous jobs (Wallace and Wilk, 1979).

Physiological changes in pregnancy include altered temperature regulation. Increased blood flow in the skin causes a considerable increase of skin temperature (Hunt, 1975). Thus, pregnancy is one of the factors that increases the risk of heat stress disorders, as is fatigue, which is also more common during pregnancy. In addition, dehydration may decrease the selectivity of the placental lipoid barrier, indicating the potential for increased fetal exposure to contaminants (Hunt, 1975).

Urinary retention due to the lack of toilets in the fields is a special problem during pregnancy, not only because of the potential adverse effects on the fetus, but also because of the necessity of frequent urination during pregnancy. Urinary retention promotes urinary tract infection, and maternal urinary tract infections during pregnancy have been associated with increased rates of perinatal deaths and with more frequent premature births. Chronic urinary tract infections can lead to eventual kidney damage (e.g., pyelonephritis) and have been associated with an increased risk of bladder cancer (see chapter VIII).

Chemical Risk Factors

Pesticides and fertilizers present a variety of potential risks to the pregnant farmworker. Her susceptibility to acute poisoning by inhalation increases because of the physiological changes in respiratory function during pregnancy. Chemical exposure has been associated with uterine bleeding during pregnancy (Hunt and Harkness, 1980). In addition, a number of pesticides have been shown to have adverse chronic effects: they may be mutagenic (causing genetic damage), teratogenic (causing birth defects), carcinogenic (cancer-causing), and/or neurotoxic (causing damage to the nervous system). (See chapter X for tables and discussion.)

Certain carcinogenic compounds can cross the placenta and be absorbed by the developing fetus. In some instances, it appears that the fetus is even more susceptible to their effects than the exposed woman herself (e.g., vinyl chloride monomer used in the manufacture of plastics).

Teratogens cause fetal damage in various ways: through the inhibition of cell proliferation, an increase in cell death, the alteration of cell differentiation; or through the inhibition of biosynthesis, tissue interactions, or cellular migration or organ development. Teratogens are specific both in terms of the nature of the abnormality they induce and the specific gestational ages at risk (Schull, 1984).

Teratogens may either kill neurons or disrupt the neurochemical development of brain circuits without producing gross morphological effects, yet still disrupting the normal functioning of the brain. It has become increasingly apparent that exposure to a wide variety of chemicals, either during pregnancy or during early postnatal life, produces functional impairments, particularly behavioral deficits, even in the absence of observable structural malformations (Council on Environmental Quality, 1981).

A study of hospital birth records in Imperial County, California showed that the rate of limb defects among infants whose parents both were farmworkers was four times greater than the rate for offspring of other parents (Schwartz et al., 1980). In a seven-year U.S. nationwide study, women with a work history of pesticide exposure were found to have the most adverse reproductive histories, observed as more fetal deaths and stillbirths, premature low-weight babies with low five-minute Apgar scores, suspected neurological abnormalities at one year, and low I.Q. at four years. No statistically significant interaction with demographic variables was found, indicating that all socioeconomic and racial groups were affected similarly (Hunt and Harkness, 1980).

Pesticide exposure is a continued concern for the female farmworker even after she gives birth since chemicals such as organochlorine or chlorinated hydrocarbon pesticides are excreted in human milk (Wallace and Wilk, 1979). Chemicals may also decrease the amount of milk that a woman can produce (Schull, 1984). Often the infant is brought to the fields to be near the mother for breastfeeding and may absorb pesticides through the skin from contact with the mother's contaminated work clothing. Infants and children are more highly susceptible to pesticide poisoning: they weigh less and thus it takes lesser amounts of pesticides to poison them.

Infectious Agents as Risk Factors

There is evidence that women are more susceptible to infection during pregnancy than at other times and that this susceptibility increases as gestation progresses. A high percentage of cases of overt or subclinical maternal viral infection result in fetal wastage, congenital defects, or neonatal illness resulting in early death or permanent disability. Transplacental transmission is probably the most common means of access of pathogens to the fetus, although there is also evidence of ascending infections from cervical lesions (Wallace and Wilk, 1979).

These infectious agents are of concern to pregnant farmworkers given the increased risk of spread of communicable diseases in unsanitary workplace and living environments. For example, hepatitis A (infectious hepatitis), a viral disease usually spread by fecal-oral contamination, has been linked to miscarriages and stillbirths. Rubella, measles, and mumps viruses cause spontaneous abortion, developmental defects, and fetal disease (Hunt, 1975).

Fecal-oral diseases that cause diarrhea are common within the farmworker population. These diseases include parasitic infections that cause anemias and malnutrition (more fully discussed in chapter VII). In addition, greenhouse and mushroom workers are at risk of developing bacterial and fungal infections. *Campylobacter* bacteria suspected of transmission to humans via contaminated food or water, has been linked to the death of a premature infant boy whose mother had had fever, chills, and diarrhea two weeks prior to the delivery. *Campylobacter* had been recognized previously as an abortifacient in animals, although treatment may prevent fetal losses in humans (Centers for Disease Control, 1984). Typhoid, typhus, and tuberculosis can cause developmental (e.g., central nervous system) defects, fetal disease, and miscarriage (the link between TB and miscarriage is tentative) (Hunt, 1975).

Additional Considerations

Adverse health effects during pregnancy may be caused by nonwork exposures or by an interaction of occupational and other exposures. For example, nutritional deficiencies and water deprivation may contribute to increased susceptibility to pesticide toxicity (Baetjer, 1983). Drugs may interact with occupational chemicals. Preexisting medical conditions can increase the risk of adverse effects from an occupational exposure. For example, diabetes is a risk factor for heat stress; previous premature births coupled with occupational fatigue, increase the risks of future premature births; and previous back injury makes one more susceptible to back injury. Medical treatments also can be harmful, for example, drugs and x-ray exposure can cause birth defects.

Personal habits must also be considered. For example, smoking during pregnancy increases the risk of a low birth weight baby. Alcohol consumption, possibly even small amounts of wine or beer, may lead to fetal alcohol syndrome.

Further exposure to potentially harmful substances can also occur from other working members of the household. For example, even when a pregnant farmworker stops working in the fields, she may still be exposed to pesticide residues if she washes or handles other family members' contaminated work clothes.

Genetic factors also play a role. A number of inherited DNA-repair-deficient phenotypes are now known to exist; most have been recognized through the inability of affected individuals to repair radiation-induced damage. It is reasonable to believe that similar phenotypes unable to repair chemically-induced DNA damage also exist. Another possible genetic risk factor might be through inherited differences in the ability to detoxify a hazardous compound. Presumably the metabolism or detoxification of a potentially hazardous agent is a biochemical process, and thus individuals who lack the requisite enzyme might experience higher exposures for the same amount of compound, whether ingested, inhaled, or absorbed through the skin (Schull, 1984).

The interrelatedness of these factors is only one of the reasons that research on the health effects of workplace exposure during pregnancy is complex. Other difficulties include: the lack of reliable exposure data; the fact that most teratogens seem to have a variety of effects depending on the timing and amount of exposure and the fetal genotype; the fact that new teratogens are spread slowly, and usually only a small and scattered population is exposed; and the fact that one-third of congenital anomalies remain undetected at birth and immediately thereafter (Saxén, 1980).

Farmworker Research

A subsample of 145 married migrant farmworker women under age 50 formed part of a study of predominantly Hispanic migrant farmworkers in Wisconsin during the 1978 planting and harvesting season (Slesinger and Okada, 1984). This study revealed that the migrant women had a higher number of pregnancies and fetal loss and used contraceptives less frequently than the general U.S. female population. Women aged 15-29 averaged 1.5 births compared with 5.7 for women 30-49. Migrant farmworker women who spoke only Spanish had borne one more child on the average than women who were bilingual (5.3 compared to 4.0). In contrast, 2.0 children were born to American women aged 15-44. Child mortality was considerable: Fifteen percent (15%) of the farmworker women surveyed who had had one or more live births also had suffered the death of a child. Over one-third of the migrant women had never used any contraceptive method. Forty-two percent (42%) were currently using contraception — 44% of those aged 15-29 compared to 40% of those aged 30-49, and 5% had been sterilized. Among the general U.S. female population, 60% of women under 30 and 40% of women 30-44 used contraception, and 30% were surgically or non-surgically sterile. Thus, a larger proportion of the migrant farmworker women were at risk of becoming pregnant, with its attendant risks to maternal and fetal health.

Watkins et al. (1985) examined the medical records of 176 prenatal patients from migrant and seasonal farmworker families in three North Carolina counties who had received care at Tri-County Community Health Center (TCCHC) in Newton Grove, North Carolina during calendar year 1982. The total sample analyzed included 171 patients with records sufficiently complete to be included in the study. Forty-five percent (45%) of the women were Hispanics, 26% Haitian, 23% black Americans, 5% were white, and 1% Native American. The mean age of the total group was 22 years and the median age 23; 27% of the total sample were 19 years of age or less and 5% were 35 years of age or older — the two groups at highest risk of pregnancy complications.

Data on obstetrical history were completed on 160 medical records. The average number of pregnancies (gravidity) was 3.1; the average number of live births (parity) was 1.98 due to a fairly high rate of fetal loss (80/1,000 pregnancies). This group had also experienced a high rate of infant and child deaths — 75 per 1,000 live births.

The most frequently documented complications during pregnancy included anemia as defined as hematocrit levels of 34% and less and/or hemoglobin levels of 11 grams or less (40% overall and 59% of the Haitian women), urinary tract infections (30%), vaginal infections (20%), sexually transmitted diseases (19%), and severe nausea and/or weight loss (17%).

Less than half of either the seasonal or migrant farmworker patients had their first prenatal visit in their first trimester of pregnancy. One-third of the total group made only one prenatal visit to TCCHC.

Sixty-six (66) live births occurred in North Carolina. Of these, five infants (7.7%) weighed 2500 grams (5 lbs. 8 oz.) or less compared to the 1982 North Carolina low birth weight rates of 6.2 for whites, 12.1 for nonwhites, and 8.1 per 100 total live births. Five had congenital defects or complications following delivery; two of these were low birth weight Hispanic twins.

TCCHC had well-child records for 48 of these children. Diarrhea resulting in weight loss and dehydration was the major health problem among these children during their first year of life. Fourteen of the children were treated for diarrhea, and eight of them were hospitalized. One infant died of a viral infection at 28 days; another died at four months from Sudden Infant Death Syndrome.

Results of a two-year prospective epidemiological study of over 1,000 pregnant Hispanic women who were seen at two migrant health centers in California currently are being analyzed to examine birth outcome in relation to level of occupational pesticide exposure and other field work conditions (e.g., the heat, stand-up work during the third trimester). Data gathered on these women include age, their work history and that of the baby's father (including work by crop and length of time), obstetrical history, smoking and drinking history, current medical conditions, socioeconomic status, and birth outcome. Low birth weight is the primary adverse outcome being examined; it may also be possible to report rates of combined anomalies (Coye and Fenster, 1984).

Children in Agriculture

The American Friends Service Committee (1970) reported that 25% of all farm labor in the United States is performed by children. Agriculture is the only industry in this country in which workers under 16 years of age are legally allowed to work (U.S.C. § 203(c)). Twelve is the legal age limit (under an amendment to the Fair Labor Standards Act, 29 U.S.C. § 203, passed by Congress in 1974), and exemptions may be granted by the U.S. Department of Labor to permit 10- and 11-year-olds to harvest potatoes and strawberries. Even after passage of the 1974 amendment, however, many children under twelve continue to do farmwork (American Friends Service Committee, 1975; Dunbar and Kravitz, 1976; Barger and Reza, 1983).

Briody (1984) analyzed factors pushing families to migrate to do farmwork. She studied a sample of 37 current (i.e., those who had migrated during 1982 or 1983) and 34 past (i.e., prior to 1982) migrating households from the lower Rio Grande Valley in Texas and tested the hypothesis that the presence of working age children was a major factor in the families' decision to do migrant farm labor. Other factors considered included age of the mother as an indication of stage in the life cycle, job instability, income per member of the household, legal status, and educational level of the parents.

Briody found that the age distributions of current and past migrant farmworker women were similar, but that current migrant women had more children and more employable (age 12 and over) children than past migrants. Although not statistically significant, the trend was that current migrant farmworkers without stable jobs had more children of working age than did past migrants (2.15 versus 1.63). In addition, when controls for income per member of the household, legal status, and parents' level of education were made, the difference between the number of children aged 12 years and older in current versus past migrant households was statistically significant: current migrant households had more working age children.

Health Data on Farmworker Children

Chase et al. (1971) evaluated 300 Mexican-American preschool children (150 boys, 150 girls) of migrant farmworkers in Colorado during the spring of 1969. Physical examination, medical history, and laboratory tests showed the following:

1. One-third of the mothers had received no prenatal care or nutritional supplements before delivery.
2. Pregnancy histories of the mothers revealed an infant mortality rate over three times higher than that of the general U.S. population (63 versus 20 deaths per 1,000 live births, respectively).
3. One-third of the mothers breastfed their babies, and 25% were still breastfeeding at 2 months.
4. One-half of the children had received no diptheria, pertussis, tetanus, or polio immunizations.
5. Almost 20% of the children were below the third percentile in height for their age.
6. The major medical problem among the children was vitamin A deficiency. One-fifth of the children tested (57/288) had vitamin A levels of 20 ug/100 ml or less, a level at which night blindness is considered detectable. Upon physical examination, the children with low vitamin A levels were found to have more frequent skin and upper respiratory tract infections.
7. Almost 20% of children tested had hemoglobin or hematocrit values below the tenth percentile for their age.

Another Colorado study (McCracken, 1979) of preschool children of migrant and seasonal farmworkers looked at 904 Spanish surnamed children enrolled in the state Head Start program during 1975. Results indicated that a significant portion of the children over six months of age were below average for all growth measures (height, weight, and head circumference). Twenty-seven percent (27%) of the children were below the third percentile for height, and 14% were below the third percentile for weight. McCracken concluded that there had not been substantial change in the patterns of growth among the preschool children of Mexican-American farmworkers since the Chase et al. study conducted between 1969-1970.

A nutrition assessment and intervention program conducted in southern Florida between 1970-1972 examined 973 households of migrant and seasonal farmworkers that included 4,450 persons (Kaufman et al., 1973). Approximately two-thirds of the study population were black and one-third Hispanic. Some of the study findings included the following information:

1. Among one-year-olds, one-third to one-half fell below the 15th percentile point in height.
2. About one-third of children under six and 50-75% of older children had periodontal disease.
3. About 10-15% of the population had below-standard serum iron levels. Children, adolescents, and to a lesser extent, adult women in their childbearing years showed the largest proportion of below-standard values.
4. There was a trend toward consistently lower levels of plasma vitamin A for Hispanics.

Another American Friends Service Committee report on child labor in agriculture (American Friends Service Committee, 1975) included a comparison of 184 farmworker and non-farmworker children (27 migrant, 72 "day haul" or seasonal, and 85 non-farmworker) between four and twelve years of age in Washington state. The AFSC report does not describe the methodology used for choosing this sample. Information was gathered from interviews with the mothers of the families and from clinic records. It is assumed that the interviews were conducted at the clinic when patients arrived for treatment and thus may not have been random selections. A comparison of the two groups of children showed that the farmworker children had a higher rate of respiratory diseases (e.g., bronchitis, pneumonia) and two and a half times the rate of strep throat compared to the non-farmworker children (41% versus 16%). The rates of viral and parasitic diseases, including gastroenteritis, stomach upset, and diarrhea were fairly high in both groups (32% for farmworker children versus 22% in the others) as were colds and sore throats.

Occupational Hazards to Children

Farmworker children are exposed to agricultural work hazards in various ways: they themselves do field work; they accompany their parents to the fields and play in or near the fields; their families live adjacent to the fields where they work; they have contact with family members wearing contaminated work clothing; and they are exposed *in utero*.

While children face many of the same work hazards as adults, they are particularly at risk for pesticide poisoning because they weigh less than adults and have faster metabolism; thus, it takes less time and less pesticide to poison them. In addition, little is known about the long-term effects of chronic pesticide exposure on children, such as the effects on onset of puberty, reproductive health, and the immune system. Given the ability of some pesticides to cause cancer, birth defects, and/or genetic damage, pesticide exposure must be considered when examining data on rare health conditions among farmworker children. Two studies have linked childhood brain tumors and leukemia to pesticide exposure (Gold et al., 1979; Hemminki et al., 1981).

No separate pesticide reentry intervals specifically for children (i.e., the period of time which must elapse after pesticide application before persons without protective clothing may safely reenter the fields) have been established as yet. Clement Associates, Inc., Washington, D.C., made recommendations to the U.S. Department of Labor regarding minimum reentry times for 10- and 11-year-olds working in potatoes and strawberries. These intervals ranged from 2-120 days (Clement Associates, Inc., 1979); they were adopted into regulations by the Department of Labor but were ruled illegal by the U.S. Court of Appeals for the D.C. Circuit in 1980 in *National Association of Farmworker Organizations v. Marshall*, 628 F.2d 604.

The lack of sanitary facilities in the fields as well as unsanitary, substandard housing contribute to the spread of communicable diseases, including parasitic conditions. As described in chapter VII, migrant children have high rates of parasitic infestations, and untreated parasitic conditions may lead to chronic anemia or malnutrition. These debilitating health problems make those children and adults who are affected yet more vulnerable to the effects of pesticides and heat stress. The lack of drinking water, toilets, and handwashing facilities increases the extent of pesticide exposure for children. Skin rashes and even generalized hypersensitivity to chemicals can result from pesticide residues (see chapters X and XI.)

Extreme fatigue from long hours of work and from the heat increases the risk of accidents. Fatigue is also a contributing factor to musculoskeletal injury. California data from 1968 showed that most of the agricultural injuries involving children were either the result of strain or overexertion or occurred when youngsters were struck by falling containers (Dunbar and Kravitz, 1976). Children who are left unattended in the fields may he hurt by machinery (e.g., run over by tractors or other equipment). Tragedies have also occurred when children have been locked in closed cars in hot temperatures and have died of heat stroke. Data from the Migrant Student Record Transfer System (Education Commission of the States, 1979) for a two-year period revealed that 71% of all deaths among migrant farmworker children were from accidents: of these, 44% were due to automobile accidents and 3% to farm accidents.

The chronic effects of hard physical labor on the musculoskeletal system of growing children and the extent of these problems are inadequately documented for farmworker children. Lipscomb et al. (U.S. Senate, 1970) saw multiple back deformities among farmworker patients in Texas; back, hip, and lower extremity pain, resembling that of degenerative osteoarthritis usually found in older patients, were common symptoms in the children and adolescents they saw.

Research Needs

There are numerous gaps in our knowledge of the health status of farmworker children. Of particular concern are the chronic effects of pesticide exposure, the extent of handicapping conditions such as birth defects and rare cancers, and musculoskeletal disorders.

Priority should be given to the provision and evaluation of preventive health services, including health education, for accident prevention (accidents are the leading cause of death among all children in the United States) and hearing, vision, nutrition, and dental screening and care. Elimination of unsanitary living and working conditions will diminish the risk of communicable diseases.

Migrant life is stressful on the entire family, yet little is known about the extent of child abuse or neglect among farmworkers, which may be one result of these stresses (Dunbar and Kravitz, 1976; Education Commission of the States, 1979).

Data collected through the Migrant Student Record Transfer System is rarely used for research purposes, and its potential must be further explored. The Migrant Head Start program keeps child health data and is a logical place to systematically study handicapping and other conditions among farmworker children. Comparisons could be made between migrant and non-migrant Head Start populations and the general population. In addition, data collected through the American Academy of Pediatrics must be analyzed for information on farmworker children's health.

REFERENCES CITED

American Friends Service Committee: *School Days, Saturdays, Sundays, and Fiestas (Children Who Work in Commercial Agriculture)*. 1975. Order from: American Friends Service Committee, 1501 Cherry Street, Philadelphia, PA 19102 for $3.50 plus postage.

American Friends Service Committee: *Child Labor in Agriculture*. A report in cooperation with the National Committee on the Education of Migrant Children, Summer 1970.

Baetjer, A.M.: Water deprivation and food restriction on toxicity of parathion and paraoxon. *Archives of Environmental Health* 38(3):168-171, 1983.

Barger, K. and Reza, E.: Survey of Midwestern Farmworkers (1983). Unpublished paper available from Ken Barger, Department of Anthropology, Indiana University-Indianapolis, Indianapolis, IN 46202 (phone: 317-264-3788) or Ernesto Reza, Department of Psychology, University of Michigan, Ann Arbor, MI 48109 (phone: 313-764-8397).

Briody, E.: The Economic and Service Contributions of Migrant Children in a Household Economy. Paper presented at the Southwestern Social Science Association Meetings, Fort Worth, Texas, March 22-24, 1984 by Elizabeth Briody, Department of Anthropology and Population Research Center, The University of Texas at Austin.

Centers for Disease Control: Premature Labor and Neonatal Sepsis Caused by *Campylobacter* fetus, Subsp. fetus — Ontario. *Mortality and Morbidity Weekly Report* 33(34):483-484,489, 1984.

Chase, H.P., Kumar, V., Dodds, J.M., et al.: Nutritional Status of Preschool Mexican-American Migrant Farm Children. *American Journal of the Diseases of Childhood* 122:316-324, 1971.

Clement Associates, Inc.: *Safety Factors for Children Employed as Hand Harvesters of Strawberries and Potatoes. Final Preliminary Report.* April 20, 1979. Prepared for the U.S. Department of Labor, Contract No. J-9-E-9-0005. Clement Associates, Inc., 1515 Wilson Blvd. #700, Arlington, VA 22209 (phone: 703-276-7700).

Council on Environmental Quality: *Chemical Hazards to Human Reproduction*. Washington, D.C.: U.S. Government Printing Office, January 1981.

Coye, M.J. and Fenster, L.: Personal communications with Molly J. Coye, M.D., M.P.H., Governor's Office of Policy and Planning, State House, Room 232, Trenton, NJ 08625 (phone: 609-292-6000 ext. 222) and Laura Fenster, epidemiologist at the University of California at Berkeley (phone: 415-540-2669) in March and June 1984.

Dunbar, A. and Kravitz, L.: *Hard Traveling: Migrant Farm Workers in America*. Cambridge, MA: Ballinger Publishing Company, 1976.

Education Commission of the States: *Interstate Migrant Education Task Force: Migrant Health*. Report No. 131, November 1979. Copies available from Interstate Migrant Education Project, Education Commission of the States, Suite 300, 1860 Lincoln Street, Denver, CO 80295 (phone: 303-861-4917).

Gold, E., Gordis, L., Tonascia, J., et al.: Risk factors for brain tumors in children. *American Journal of Epidemiology* 109:309-319, 1979.

Hemminki, K., Saloniemi, I., Salonen, T., et al.: Childhood cancer and parental occupation in Finland. *Journal of Epidemiology and Community Health* 35:11-15, 1981.

Hunt, V.R.: *Occupational Health Problems of Pregnant Women: A Report and Recommendations for the Office of the Secretary, Department of Health, Education and Welfare*, April 30, 1975. Order No. SA-5304-75. For copies, contact: U.S. Department of Health and Human Services, Office of the Secretary, 330 Independence Avenue, S.W., Washington, D.C. 20201 or: Vilma R. Hunt, Department of Environmental Health, The Pennsylvania State University, University Park, PA 16802 (phone: 814-863-2902 or 814-863-2859).

Hunt, V.R. and Harkness, W.: Occupational Hazards to Pregnant Women in the Collaborative Perinatal Project. In: *Proceedings of A Workshop on Methodology for Assessing Reproductive Hazards in the Workplace*, April 19-22, 1978 (P.F. Infante and M.S. Legator, eds.). Washington D.C.: U.S. Government Printing Office, October, 1980, pp. 377-404.

Kaufman, M., Lewis, E., Hardy, A.V., et al.: *Families of the Fields: Their Food and Their Health*. Monograph Series No. 13. Jacksonville, FL: Division of Health, Department of Health and Rehabilitative Services, State of Florida, 1973.

McCracken, R.D.: Growth and Nutritional Status of Migrant Farmworker Preschool Children: Are the Programs Working? *The Farmworker Journal* Winter 78-79, Volume 1 No. 1, pp. 4-20. Published by the Farmworker Data Network, 7905 W. 44th, Wheat Ridge, CO 80033.

Mamelle, N., Laumon, B., and Lazar, P.: Prematurity and Occupational Activity During Pregnancy. *American Journal of Epidemiology* 119(3):309-322, 1984.

Morgan, D.P.: *Recognition and Management of Pesticide Poisonings* (Third edition). Washington, D.C.: U.S. Government Printing Office, U.S. Environmental Protection Agency Publication No. 540/9-80-005, January 1982.

Saxén, L.: Epidemiological Studies for Detection of Teratogens. In: *Proceedings of a Workshop on Methodology for Assessing Reproductive Hazards in the Workplace*. April 19-22, 1978 (P.F. Infante and M.S. Legator, eds.). Washington, D.C.: U.S. Government Printing Office, 1980.

Schull, W.J.: Reproductive Problems: Fertility, Teratogenesis, and Mutagenesis. *Archives of Environmental Health* 39(3):207-212, 1984.

Schwartz, D., Newsum, L., and Heifetz, R.M.: Parental Occupation and Birth Outcome in an Agricultural Community. Unpublished paper, 1980. Project funded by the National Science Foundation and the Shalan Foundation. For a copy, contact: David Schwartz, M.D., 593 Quincy Shore Drive, Woollaston, MA 02170.

Slesinger, D.P. and Okada, Y.: Fertility Patterns of Hispanic Migrant Farm Women: Testing the Effects of Assimilation. *Rural Sociology* 49(3):430-440, 1984.

U.S. Senate: *Migrant and Seasonal Farmworker Powerlessness. Hearings before the Subcommittee on Migratory Labor of the Committee on Labor and Public Welfare.* Ninety-first Congress, First and Second Sessions on Who is Responsible. Part 8-A, July 20, 1970. Washington, D.C.: U.S. Government Printing Office, 1970, pp. 5074-5077.

Wallace, R.B. and Wilk, V.A.: Occupational Hazards. Chapter 9 in: *Trauma in Pregnancy* (H.J. Buchsbaum, ed.). Philadelphia: W.B. Saunders Company, 1979, pp. 167-188.

Watkins, E.L., Peoples, M.D., and Gates, C.: Health and Social Needs of Women Farmworkers Receiving Maternity Care at a Migrant Health Center. *Migration Today* XIII (2):39-42, 1985.

Werner, E.E. et al.: *The Children of Kauai*. Honolulu: University of Hawaii Press, 1971.

XVIII. Other Factors Affecting Farmworker Health

Factors other than direct workplace exposures also affect the health and safety of workers. This chapter reviews some of these considerations, including housing, farmworker labor union contracts, migration, poverty, pre-existing medical conditions, alcoholism, and undocumented worker status, and discusses how they influence the health status of farmworkers.

Housing

The impact of substandard housing on health is briefly discussed in this chapter even though it can be argued that housing conditions are workplace exposures since employers frequently provide farmworker living quarters, and those quarters are often adjacent to the fields.

Substandard housing contributes to an increased risk of accidents and sanitation-related diseases for adults and children alike. Housing may have faulty electrical wiring or appliances; it may lack adequate lighting, proper fire exits, or fire extinguishers. Overcrowding, inadequate or nonexistent heating, poor ventilation, and unsanitary conditions inside and outside a unit enhance the spread of such diseases as upper respiratory tract infections, influenza, and tuberculosis. Garbage heaps and stagnant water are breeding grounds for rats, insects, and flies, which harbor and transmit disease. Inadequate or faulty plumbing systems can produce contaminated drinking water often resulting in gastrointestinal illnesses such as parasites or diarrhea.

These communicable illnesses have various implications: lost workdays and/or reduced wages due to lower productivity; an increased risk of nutritional deficiencies and dehydration, which in turn increase the worker's risk of pesticide poisoning and heat stress. Diarrhea among infants and children can be fatal. One illustration is the diarrheal outbreak in Somerset County, Maryland during July and August of 1982. One nine-month-old boy died, and over 80% of the infants and 40% of the two- to four-year-olds in the migrant labor camp contracted diarrhea (State of Maryland Governor's Commission on Migratory and Seasonal Farm Labor, 1982).

Migrant farmworker housing rarely has laundry facilities, which means that work clothes contaminated with pesticide residues may be washed in the kitchen sink or the bathtub (Aranda et al., 1978). This puts all inhabitants of the housing unit at risk of pesticide exposure. Inability to wash work clothes also means that workers will wear the same clothing for more than one day and, thus, increase the extent of their exposure to pesticide residues.

The location of farmworker housing may mean that workers and their families are exposed to workplace hazards even when they are not on the job. Housing may be located adjacent to fields that are regularly treated with pesticides. Residences are subjected to pesticide drift or even direct spray. Clothing hung outside to dry is contaminated; windows left open allow spray to enter. In some cases workers do not even have housing but live under plastic tarpaulins in orchards, for example, and use the contaminated water from irrigation ditches for drinking, cooking, and bathing.

Two national studies (Aranda et al., 1978; Cavenaugh et al., 1980) have examined the status of migrant and seasonal farmworker housing. Cavenaugh et al. (1980) estimated that there was adequate shelter for only 425,000 migrant farmworkers and their families.

Farmworker Labor Unions

The Bureau of Labor Statistics (1985) estimates that 5.5% of U.S. workers who fall under the category "farming, fishing, and forestry industries" belong to labor unions. Collective bargaining agreements provide farmworkers with benefits not enjoyed by non-unionized workers including, for example, better housing, workplace sanitation facilities and drinking water, health insurance coverage, and wage increases — factors which all contribute to a healthier workforce.

Health coverage under the United Farm Workers (UFW) contracts is provided under the Robert F. Kennedy Farm Workers Medical Plan. This plan provides a maximum of three types of coverage—medical, vision, and dental. This health plan has just recently begun to charge a deductible to the farmworker (Moses, 1986).

In February 1986, the Farm Labor Organizing Committee (FLOC) signed a contract for 600 farmworkers with a group of tomato and cucumber growers in Ohio and Michigan and the Campbell Soup Company, Camden, New Jersey. The major provisions of the contract include guaranteed jobs, higher wages, improved housing and working conditions, and health care coverage (*New York Times*, 1986).

Migration

The very nature of agricultural migratory life is stressful and creates health risks. Transportation accidents account for high rates of death among migrant farmworkers (Education Commission of the States, 1979; Whiting, 1975). The migrants' physical and social isolation from the communities and the sense of hopelessness in getting ahead lead to feelings of despair, depression, and lack of self-worth (Task Panel on Migrant and Seasonal Farmworkers, 1978).

Migration often means a farmworker family will seek medical care away from home, and this lack of continuity of care by one provider or health center may adversely affect a patient. For example, children may receive multiple immunizations, or patients with chronic conditions such as diabetes or hypertension may be overmedicated because they are taking medications prescribed by different doctors. As discussed earlier, migration may also mean that farmworkers forego medical care altogether due to obstacles such as lack of transportation from the fields or the labor camps to a health care facility, limited access to clinics open only during the regular working day, and lack of health insurance coverage.

Poverty

Poor health is linked to poverty as well. The health literature shows that members of lower socioeconomic groups experience higher incidence, severity, and mortality from most diseases. Haan et al. (1984) compared the health status of the residents of federally designated poverty versus nonpoverty areas of Oakland, California over a nine-year period. Mortality rates were higher for the poverty area residents for both men and women, white and black, by 20-67% (depending on the specific age-sex-group category). This increase in death rates remained even after the following variables were controlled: income, lack of medical care, unemployment, ethnicity, health practices, social connections, or psychological factors. These authors concluded that characteristics of the geographic areas themselves are associated with increased risk of poor health. The possible explanations they offered included differences in the quality of the physical environment (e.g., dilapidated housing, fires), higher levels of social stress factors (e.g., high crime rate), and higher risks associated with lower status occupations.

A number of these environmental and work stressors for farmworkers have already been discussed in this report: long working hours in hot climates, inadequate drinking water, the lack of sanitary facilities at the workplace, poor housing, the pressures of working for piece rate, and pesticide exposure. In addition, farmworkers are dependent on the crewleader or labor contractor and are frequently exploited. Taken to the extreme, this can take the form of violence and/or peonage (Parker and Hemingway, 1981).

Alcoholism

Social isolation, and especially separation from family during the harvest season, contributes to alcohol and drug usage. Mattera et al. (1983) studied migrant farmworker drinking behavior in upstate New York and found that in camps composed primarily of family groups, social control mechanisms were more highly developed than in camps composed primarily of unattached men. These variations were reflected in differences in drinking behavior. Older black men accounted for most of the heavy drinking in migrant farmworker camps, while people traveling in family groups under the surveillance and control of kin and often with children to care for, reported less frequent and less heavy drinking — and less trouble as a result. The authors suggested two possible explanations: there may have been a drift of increasing numbers of homeless men into migrant farmwork; or there may have always been alcoholics in the migrant farmworker stream in this region, but they may have become more visible as family groups have left migrant farmwork (thus they are a residual group).

Alcoholism is a contributing factor to hypertension, and alcohol consumption on the job puts the worker at increased risk of heat stress disorders and accidents.

Medical Conditions

Given certain work conditions, pre-existing medical problems and accompanying treatments can put workers at higher risk of developing further problems. For example, the toxicity of many pesticides is increased by a person's nutritional deficiencies (Mahaffey and Vanderveen, 1979; Shakman, 1974). Diabetes, hypertension, diarrhea, pregnancy, obesity, acute febrile illnesses, drugs such as diuretics and anti-depressants, and poor physical condition increase the risk of heat-related illness.

Undocumented Worker Status

The constant fear of being reported, detained, and expelled from the United States is an added stress for those farmworkers who do not have legal status. To avoid detection they tolerate substandard living and working conditions and forego medical care until it can no longer be ignored. Thus, preventive or routine care (e.g., pre- and postnatal care, TB screening, and inoculations) often is neglected. In a 1984 article, Guttmacher discusses the plight of recent immigrants with regard to health and health policy.

110

REFERENCES CITED

Aranda, R. and Lujan, H.: *A Study of Housing for Migratory Agricultural Workers*. InterAmerica Research Associates, June 12, 1978. For more information, contact: InterAmerica Research Associates, Inc., 1555 Wilson Blvd., Rosslyn, VA 22209 (phone: 703-522-0870).

Bureau of Labor Statistics: *Employment and Earnings*. Washington, D.C.: U.S. Government Printing Office, January 1985.

Cavenaugh, D., Schmidt, R., and Mitzel, H.: *National Farmworker Housing Study: Study of Housing for Migrant and Settled Farmworkers*. InterAmerica Research Associates, Inc., December 1980. Contact: David Cavenaugh, National Association of Community Health Centers, Inc., 1625 "I" St., N.W., Suite 420, Washington, DC 20006 (phone: 202-833-9280).

Education Commission of the States: *Interstate Migrant Education Task Force: Migrant Health*. Report No. 131, November 1979. Copies available from Interstate Migrant Education Project, Education Commission of the States, Suite 300, 1860 Lincoln Street, Denver, CO 80295 (phone: 303-861-4917).

Guttmacher, S.: Immigration Workers: Health, Law, and Public Policy. *Journal of Health Politics, Policy and Law* 9(3):503-514, 1984.

Haan, M.N., Kaplan, G.A., and Camacho-Dickey, T.: Poverty and Health: A Prospective Study of Alameda County Residents. Paper presented at the 17th Annual Meeting of the Society for Epidemiologic Research, Houston, Texas, June 14, 1984. Contact: Mary N. Haan, Human Population Laboratory, California Dept. of Health Services, 2151 Berkeley Way, Annex 2, Room 211, Berkeley, CA 94704-9980.

Mahaffey, K.R. and Vanderveen, J.E.: Nutrient-toxicant Interactions: Susceptible Populations. *Environmental Health Perspectives* 29:81-87, 1979.

Mattera, G., Watson, J., Kunitz, S., et al.: *Alcohol Use Among Migrant Laborers*. Final Report, 1983. For more information, contact: Dr. Gloria Mattera, Director, Geneseo Migrant Center, Holcomb Building 210-211, Geneseo, NY 14454 (phone: 716-245-5681).

Moses, M.: Telephone conversation with Marion Moses, M.D., Medical Director, National Farm Workers Health Group, La Paz, Keene, California 93531 (phone: 805-822-5571), 1986.

New York Times: Campbell Soup Accord Ends a Decade of Strife, Monday, February 24, 1986.

Parker, H.H., III, and Hemingway, D.C.: *Crewleader Violence Against Farmworkers in North Carolina*. A Report Prepared for the North Carolina Chapter of the National Lawyers Guild, 1981.

Shakman, R.A.: Nutritional Influences on the Toxicity of Environmental Pollutants. *Archives of Environmental Health* 28:105-13, 1974.

State of Maryland Governor's Commission on Migratory and Seasonal Farm Labor: *Annual Report to the Governor*, December 31, 1982. For copies, contact the Commission at: 1123 N. Eutaw Street, Suite 310, Baltimore, MD 21201 (phone: 301-383-2248).

Task Panel on Migrant and Seasonal Farmworkers: *Report Submitted to the President's Commission on Mental Health*, February 15, 1978.

Whiting, W.B.: Occupational Illnesses and Injuries of California Agriculture Workers. *Journal of Occupational Medicine* 17(3):177-181, 1975.

XIX. Occupational Safety and Health Laws Protecting Farmworkers

This chapter outlines federal and state legislation and regulations that have a direct or indirect impact on farmworker safety and health. Lack of legal coverage of farmworkers not only means lost benefits to the workers (e.g., in the case of workers' compensation) but also lost opportunities for data gathering and analysis about farmworker safety and health.

This chapter outlines federal and state legislation and regulations that affect farmworker occupational safety and health. Farmworkers, unlike any other group in this country, have either been totally or partially denied the full benefits of such laws as the National Labor Relations Act, the Fair Labor Standards Act, workers' compensation, unemployment compensation, and Social Security. The National Labor Relations Act guarantees virtually every other worker in the United States the right to organize into unions and bargain collectively (Schacht et al., 1982). Few states recognize such rights for farmworkers, and some of those state laws contain powerful obstacles to effective union organizing and representation. For example, Kansas prohibits strikes during harvest; Arizona allows a grower to deny a union access to its workers. Lack of coverage for work-related illness and injury and lack of compensation for lost work time often result in untreated or inadequately treated illnesses or health problems due to workers' lack of money and their need to keep absenteeism to a minimum. The lack of workplace health standards for agricultural workers means that employers have less incentive to give farmworkers a healthy and safe work environment. Even when laws and regulations exist, active enforcement is necessary to prevent unsafe workplace conditions.

Although farmworkers have been excluded from most labor laws, Congress has passed some protective legislation including the Migrant Health Act, which provides funding to clinics to serve migrant farmworkers and their families, the Occupational Safety and Health Act, the 1966 Amendments to the Fair Labor Standards Act, which include certain farmworkers within the minimum wage guarantees and protections against the use of child labor, and the Agricultural Worker Protection Act, which was signed into law in 1983.

It is not possible to do an exhaustive review of farmworker legislation here, but the reader should refer to the citations at the end of this chapter and to those for chapter XIX in the bibliography (chapter XX).

The Occupational Safety and Health Act (OSHAct)

In 1970, the Occupational Safety and Health Act (29 U.S.C. Section 651 *et seq.*) was enacted to "assure safe and healthful working conditions for working men and women" in the United States.

This Act requires employers to comply with all occupational safety and health standards promulgated by the Secretary of Labor; however, Congressional appropriations acts have exempted farms with ten or fewer employees unless the farm maintains a temporary labor camp or migrant housing facility. It is estimated that 85% of farmworkers are employed on farms that employ ten or fewer employees (Migrant Legal Action Program, Inc. and the Farmworker Justice Fund, Inc., 1984).

In addition, the Act provides that it shall not "apply to working conditions of employees with respect to which other federal agencies exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety and health." One U.S. Federal Court of Appeals decision in 1975 (*Organized Migrants in Community Action, Inc. v. Brennan*, 520 F.2d 1161) held that the U.S. Environmental Protection Agency's authority to promulgate rules regulating farmworker exposure to pesticides under the Federal Environmental Pesticide Control Act preempted the Secretary of Labor from issuing a permanent pesticide standard. Thus, farmworkers are the only workers for whom toxic substances in the workplace are not federally regulated by the Occupational Safety and Health Administration.

The OSHAct contains only five specific standards that apply to agricultural operations:

1. *Sanitation in temporary labor camps.* This standard encompasses site, shelter, water supply, toilet facilities, sewage disposal facilities, laundry, handwashing, and bathing facilities, lighting, refuse disposal, construction and operation of kitchens, dining hall and feeding facilities, insect and rodent control, first aid, and reporting of communicable diseases (29 C.F.R § 1910.142). It covers all new labor camp housing constructed after April 3, 1980. Housing built before that time is covered by the OSHA standard or the Department of Labor's Employment and Training Administration standard, 20 C.F.R. § 654.400, at the grower's option. Temporary labor camps, according to decisions by the Occupational Health and Safety Commission, include bunkhouses on farms operated year-round where some employees stay continuously; motels where employees are required to stay but no other people stay; and some houses for members of single family units provided over a period of years.
2. *Storage and handling of anhydrous ammonia.* This standard includes the approval of equipment and systems, safety relief devices, and training in safe handling practices of this fertilizer (29 C.F.R. §§ 1910.111).
3. *Slow-moving vehicle emblem.* This standard requires slow-moving vehicles to display a fluorescent yellow-orange triangle with a dark red reflective border (29 C.F.R. §§ 1910.145(d)(10)).
4. *Roll-over protective structures.* This standard requires roll-over protective structures (ROPS) of certain design and specifications for most agricultural tractors manufactured after October 25, 1976. Seat belts also are required for these tractors. Tractors

mounted with implements incompatible with a ROPS may be operated without the ROPS. Employers must enforce prescribed safe operating rules whether or not a ROPS is required (29 C.F.R. §§ 1928.51-.53).

5. *Safety for agricultural equipment.* This standard encompasses operating instructions, methods of guarding, strength and design of guards, power take-off guarding, electrical disconnect means, access to moving parts and nip-point guarding for farm field equipment, farmstead equipment, and cotton gins (29 C.F.R. § 1928.57).

The General Duty Clause

In addition to complying with specific standards promulgated by the Secretary of Labor, each employer "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees" (29 U.S.C. § 654(a)(1)).

Since agricultural operations are exempt from all but a few OSHA general industry standards, work hazards such as the short-handled hoe, unsanitary field conditions, and use of dangerous tools must be specifically cited by OSHA inspectors as violations of the general duty clause.

To support a finding of a violation of the general duty clause, the Secretary must prove that the hazard cited was:

- Preventable;
- Recognized (i.e., known by the employer or recognized by safety experts);
- Causing or likely to cause death or serious physical harm.

Proposed Federal Field Sanitation Standard

On March 1, 1984, OSHA published a proposed field sanitation standard for agricultural workers (*Federal Register*, Vol. 49, No. 42, pp. 7589-7605). This standard requires that agricultural employers of eleven or more workers provide the following facilities to employees without charge:

(1) Potable drinking water, cool and in sufficient amounts, dispensed in single-use drinking cups or by fountains; and

(2) One toilet and one handwashing facility for each 20 employees or fraction thereof, within ¼ mile of the employee's work area in the field.

There were five administrative hearings on the proposed standard held by OSHA during May and June of 1984, as well as comment periods before and after the hearings. Despite unanimous medical and public health testimony supporting the standard, the Department of Labor published its refusal to issue a field sanitation standard on April 16, 1985 (*Federal Register*, Vol. 50 No. 73, pp. 15086-15092). On May 7, Secretary of Labor William Brock received a petition from 29 labor, health, and religious groups for a reversal of this decision.

On October 21, 1985, the Department of Labor announced that it was reopening the rulemaking record on field sanitation, and that the Secrtary had decided that further regulation was required to deal with farmworkers' health problems (*Federal Register*, Vol. 50, No. 203, pp. 42660-42663). The notice stated that OSHA would issue a federal field sanitation standard within 24 months "in the event the states do not take the necessary action within the next 18 months." The Department of Labor did not specify, however, how many states must fail to promulgate standards in order to trigger federal action.

The struggle for promulgation of a federal field sanitation standard dates back to 1972 when the Migrant Legal Action Program, Inc. (MLAP), Washington, D.C., petitioned OSHA for the standard on behalf of farmworker organizations. In 1973, MLAP brought suit on behalf of the National Congress of Spanish-speaking Citizens ("El Congreso") against the Secretary of the Department of Labor, Ray Marshall (C.A. 2143-73) in the District Court of the District of Columbia. The case is still pending and is known as *Farmworker Justice Fund, Inc. v. William E. Brock*.

State Field Sanitation Statutes

Even though federal coverage does not yet exist, fourteen states currently have field sanitation regulations for farmworkers. Some states have even more extensive coverage than the proposed OSHA standard. Table 46 summarizes and compares the current state regulations.

Other State Legislation

Occupational Safety and Health Acts—Besides the fourteen states with specific field sanitation legislation, 20 states plus Puerto Rico have occupational safety and health acts with general provisions that employers, including those employing farmworkers, have a duty to protect the safety of workers or to provide safe places of employment. These states and the citations of the acts are listed below:

ALASKA, *Alaska Statutes*, Sec. 180.60.010 *et seq.*
ARIZONA, *Arizona Revised Statutes*, Sec. 23-401 *et seq.*
HAWAII, *Hawaii Revised Statutes*, Sec. 396
INDIANA, *Indiana Code*, Sec. 22-8-1.1-1 *et seq.*
IOWA, *Iowa Code*, Sec. 88.1 *et seq.*
KENTUCKY, *Kentucky Revised Statutes*, Sec. 338.010 *et seq.*
MARYLAND, *Maryland Annotated Code*, Art. 29, Sec. 28 *et seq.*
MICHIGAN, *Michigan Statutes Annotated*, Sec. 17.50(1) *et seq.*
MINNESOTA, *Minnesota Statutes*, Sec. 182.65
MONTANA, *Montana Revised Codes Annotated*, Secs. 50.70.1 and 50.71.1
NEVADA, *Nevada Revised Statutes*, Sec. 618.005 *et seq.*
NEW MEXICO, *New Mexico Statutes Annotated*, Sec. 50-9-1
NORTH CAROLINA, *North Carolina General Statutes*, Sec. 95-126 *et seq.*
PUERTO RICO, *Laws of Puerto Rico Annotated*, Title 29, Sec. 361 *et seq.*

TABLE 46
A COMPARISON OF STATE FIELD SANITATION REGULATIONS*

	Toilet Facilities		*Handwashing Facilities*				
State	*Required*	*Ratio Facility/Number of Workers*	*Required*	*Moist Towelettes Allowed as Substitute for Water*	*Maximum Time/Distance to Facilities*	*Drinking Water Required*	*Minimum Numbers of Workers for Coverage*
Arizona**	Yes	1/40	Yes	No	Within ¼ mile	Yes	5
California (Food)	Yes	1/40	Yes	No	Within 5 min. walk or closest vehicular access	Yes	5
(Nonfood crops)	Yes	Various ratios	No	N/A†	Within 200 ft (61m)	Yes	1
Connecticut	Yes	1/20 male 1/10 female	Yes	No	"Readily Accessible"	Yes	1
Florida	Yes	1/40	Yes	Yes	If < 10 workers "available" if >9 workers "@ location"	Yes	1 (water) 10 (other facilities)
Idaho	Yes	1/40	No	N/A	Within ¼ mile (402m) or closest vehicular access	No	8
Illinois	Yes	1/35	Yes	Yes	Within 1/6 mile (268m); if < 10 workers, ½ mile (805m) or 5 min.	Yes	10
Maine‡	Yes	Sufficient number	Yes	Yes	"Reasonably Accessible"	Yes	11
Minnesota§	No		No	N/A		Yes	No minimum
New Jersey	Yes	Suitable number	Yes	Yes	Not more than 5 min. walk	Yes	6
New York	No	N/A	No	N/A	"Reasonably Accessible"	Yes	5
North Carolina	No	N/A	Yes	Yes	For drinking water, 200 yds (183m); for handwashing (if requested) at point of customarily used access "Readily Accessible."	Yes	11
Oregon	Yes	1/40, 1/25 if 5 or more hrs. worked/day	Yes	Yes	"Readily Accessible"	Yes	No minimum
Pennsylvania	Yes	Various ratios	Yes	Yes	"Reasonable distance"	Yes	No minimum
Texas	Yes	1/30	Yes	No¶	Within unimpeded walk of 440 yd, or 400m, or ¼ mile	Yes	7

† Not applicable. ‡ Blueberry workers only. § Corn detasselers only. ¶ Except on temporary basis. **Approved 1/20/86. Effective 4/30/86 pending final action by Attorney General.

*Adapted from *Federal Register* Vol. 49, No. 42, p. 7597, March 1, 1984.

SOUTH CAROLINA. *South Carolina Code*. Sec. 41-3-510 *et seq*.
TENNESSEE. *Tennessee Code Annotated*. Sec. 50-501 *et seq*.
UTAH. *Utah Code Annotated*. Sec. 35-9-1
VERMONT. *Vermont Statutes Annotated*. Title 18. Sec. 1415 *et seq*.
VIRGINIA. *Virginia Code*. Sec. 40.1-44.1 *et seq*.
WASHINGTON. *Washington Revised Code*. Sec. 49.17.010 *et seq*.
WYOMING. *Wyoming Statutes*. Sec. 27-11-101

Federal Pesticide Legislation: Federal Insecticide, Fungicide And Rodenticide Act (FIFRA)/Federal Environmental Pesticide Control Act (FEPCA)

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), as amended by the Federal Environmental Pesticide Control Act of 1972 (FEPCA), governs pesticide manufacture, distribution, and use. The Act provides for the registration and labeling of pesticides, the cancellation and suspension of that registration, research and monitoring, and the issuance of regulations.

For farmworkers, the most useful parts of the law are those that govern the labeling of pesticides. Registered companies must package their pesticides under labels that show the company's name, the trademark, the ingredients, directions for use, and cautionary words that are "adequate to protect health and the environment."

If any ingredient is toxic to human beings, the pesticide label must read "poison" in red against a contrasting background. The label must also show a skull-and-crossbones and describe a practical treatment for poisoning. It must be easily readable, and not detached or defaced.

It is unlawful for anyone to use a pesticide in a manner inconsistent with the directions on the label.

The regulations under FIFRA that are of use to farmworkers are the "Worker Protection Standards for Agricultural Pesticides" (40 C.F.R. Part 170). These regulations were issued in May 1974 and prohibited exposing workers directly or indirectly (through drift) to pesticides; the regulations established reentry times for twelve pesticides, required persons not wearing protective clothing to leave treated areas, and required provision of oral and/or written warnings to farmworkers working in treated fields. For pesticides without a specific reentry interval, it is necessary to wait until the dust has settled or the spray has dried before workers can enter the treated fields.

On August 15, 1984, the U.S. Environmental Protection Agency published an advance notice of proposed rulemaking to revise 40 C.F.R. Part 170 (*Federal Register*, Vol. 49, No. 159, pp. 32605-32609, August 15, 1984) including considerations to expand the scope of the regulations, revise reentry times, protective clothing provisions, and the standard for warnings, and impose other types of safety requirements such as worker education and training. On September 19, 1985, EPA published its intent to establish an advisory committee to negotiate these rulemaking issues (*Federal Register*, Vol. 50, No. 182, pp. 38030-38033). The committee, composed of industry, labor, health, EPA, and state agency representatives, was scheduled to meet between December 1985 and March 1986 to attempt to reach a consensus and assist in drafting the language for the proposed revised regulations. However, the farmworker representatives withdrew from this process after the February meeting, and the formal negotiated rulemaking has halted.

State Pesticide Laws

Under Section 24(a) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the states are granted broad authority to regulate the sale and use of pesticides. All states except Nebraska and Colorado have been granted primary enforcement authority over pesticide misuse.

State Worker Protection Regulations

California, Texas, New Jersey, and North Carolina afford farmworkers more extensive protection against pesticides than does the federal government (see Appendix II).

California has established reentry intervals from one to 70 days for about 80 pesticides. Reporting of pesticide-related illness by physicians is required by law.

The Texas regulations were promulgated by the Texas Department of Agriculture and went into effect in January 1985. They cover field workers in labor-intensive crops that entail substantial contact with pesticide residues, i.e., fruit, vegetable, seed corn, and sorghum workers. The standards establish 24-hour reentry intervals for all Toxicity Category I chemicals (those labeled "Danger") and procedures to set 24-hour reentry periods for chemicals for which the absence of undue chronic effects cannot be demonstrated. An advisory committee was established to help the Texas Department of Agriculture develop reentry intervals.

New Jersey and North Carolina require a 24-hour reentry interval for all Toxicity Category I pesticides.

Right-To-Know Legislation

State Laws

Since 1981, 15 states have passed toxic substance right-to-know legislation, which provide certain workers the right to obtain information regarding the toxic substances to which they are exposed in the workplace. The employer's responsibility may include worker health and safety training, provision of fact sheets on workplace chemicals (also called "Material Safety Data Sheets"), posting of work areas, provision of protective clothing, and/or maintenance of employee health records and employee access to them. In some states, the law includes the employee's right to refuse to work if the required information is not provided (e.g., Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, and Wisconsin).

Farmworkers are specifically covered in the Washington, Pennsylvania, and Minnesota laws. While Wisconsin does not exclude farmworkers, its law lacks enforcement authority. In Wisconsin and Minnesota, employers must provide training on chemical labeling, the symptoms of pesticide poisoning, and proper handling procedures to any employee who may be exposed to a pesticide in the workplace. In Washington, the State Department of Labor and Industries is required to translate Material Safety Data Sheets and other information into the five most common worker languages in the state. In addition, the Right to Know Advisory Council includes a migrant farmworker representative. The Pennsylvania Worker and Community Right To Know Act requires employers, chemical manufacturers, and chemical suppliers to label all containers with chemical or common names, display hazard warnings where appropriate, maintain Material Safety Data Sheets in every appropriate work area, post regulations, educate and train all employees about hazardous chemicals in the workplace, provide information upon request to emergency response agencies, and maintain employee health records, giving the employee access to them.

Two states — New Jersey and West Virginia — have specifically excluded farmworkers from coverage. In the remaining states (California, Connecticut, Illinois, Maine, Massachusetts, New York, New Hampshire, and Rhode Island), farmworker coverage is unclear: farmworkers are not specifically excluded; however, the full extent of their coverage will not be known until the rules and regulations under this legislation are promulgated.

Some states only include employers with ten or more employees (e.g., Minnesota), which effectively excludes farmworkers in many states. Illinois covers employers with 20 or more employees or five or more full-time employees.

Federal Regulation

In November 1983, the U.S. Department of Labor established a federal right-to-know regulation requiring chemical manufacturers to label containers of hazardous chemicals with appropriate warnings and to prepare "Material Safety Data Sheets" giving information for safe use of the chemicals. This Occupational Safety and Health Administration Hazard Communication Standard also requires employers to give workers information and training on hazardous chemicals in their work areas and to have safety sheets available for employees to inspect. Unfortunately, the regulation only covers workers in manufacturing.

The following states and Puerto Rico have adopted the federal OSHA Hazard Communication Standard: Virginia, Hawaii, North Carolina, South Carolina, Tennessee, Nevada, Utah, Washington, Arizona, Kentucky, Vermont, and New Mexico. Alaska had enacted right-to-know legislation in 1983, which has been superseded by this federal regulation. The Alaska regulation covers all employers except those with residential businesses. In 1984, Iowa enacted legislation that incorporated the federal OSHA Hazard Communication Standard with some additions, including community right-to-know; however, this legislation applies to all employers *except* farmers. In 1985, the North Carolina OSHA Hazard Communication Standard was amended to include agricultural employers with 10 or more employees.

On May 24, 1985, the U.S. Court of Appeals for the Third Circuit decided that it was arbitrary for the federal regulation to exclude farmworkers and others. The court ordered the Secretary of Labor to reconsider applying the regulation to these other workers (*United Steelworkers of America v. Auchter*, No. 83-3554). If worker coverage under the federal regulation is changed to include farmworkers and other non-manufacturing workers, the federal standard may preempt some state laws. For example, in a 1985 decision in New Jersey (*New Jersey State Chamber of Commerce v. Hughey*, 600 F.Supp. 606 (D.N.J. 1980)), the federal district court held that New Jersey's right-to-know protections for manufacturing workers were preempted by the federal OSHA Hazard Communication Standard.

Workers' Compensation

Almost half of the states provide no coverage for agricultural workers under workers' compensation laws. This means not only that workers' medical costs for work-related injuries are not paid by the employer, but also that work injury and illness statistics for agriculture may not even be collected in those states. Even in states where workers' compensation covers agricultural workers, many farmworkers do not understand that medical expenses and lost wages due to illness or injury are due them.

TABLE 47
WORKERS' COMPENSATION FOR AGRICULTURAL WORKERS*

Complete Coverage: (15)

Arizona
California
Colorado
Connecticut
Hawaii
Massachusetts
Michigan
Montana
New Hampshire
New Jersey
Ohio
Oregon
Pennsylvania
Puerto Rico
Washington

Partial Coverage: (16)

Alaska
Florida
Illinois
Iowa
Maryland
Minnesota
New York
North Carolina
Oklahoma
South Carolina
Texas
Utah
Vermont
Virginia
West Virginia
Wisconsin

No Coverage: (20)

Alabama
Arkansas
Delaware
Georgia
Idaho
Indiana
Kansas
Kentucky
Louisiana
Maine
Mississippi
Missouri
Nebraska
Nevada
New Mexico
North Dakota
Rhode Island
South Dakota
Tennessee
Wyoming

*For more information, see: *It's Not All Sunshine and Fresh Air: Chronic Health Effects of Modern Farming Practices*. April, 1984 (pp. 89-100). Written and published by: Center for Rural Affairs, Box 405, Walthill, NE 68067. Cost: $5.00 plus $1.00 postage and handling.

Table 47 lists the states and Puerto Rico by type of coverage under workers' compensation. States with "complete coverage" generally protect agricultural workers to the same extent as other workers. States that provide "partial coverage" may cover migrant, but not seasonal workers, or exempt employers who hire small numbers of workers (generally, fewer than three or four) or who have less than a certain annual payroll. For example, in Texas, a March 1984 court decision held that it was unconstitutional for the state to exclude all farm and ranch workers from coverage; however, the new law passed by the legislature, effective January 1985, covers all migrant farmworkers but does not cover seasonal farmworkers who labor for owners with less than a certain annual payroll, who do not work with migrant farmworkers, or who work in crops other than fruits and vegetables.

Child Labor

The 1966 amendments to the Fair Labor Standards Act (FLSA) of 1938 extended some child labor protection to farmworkers. A 1974 amendment set age 12 as the legal age limit to do farmwork, although exemptions for 10- and 11-year-olds were granted shortly thereafter.

The terms of FLSA include:

1. *Children Under Age 12* — May work in agriculture only outside local school hours, only with the consent of their parents, and only on smaller farms where employers are not required to pay the federal minimum wage. Children age 10 and 11 may also do hand harvest work on larger, minimum-wage farms, but only if the farmer has a special permit from the Labor Department to employ such children, only for up to eight weeks between June 1 and October 15, only outside school hours, and only if the children travel daily from their permanent home to the farm. In addition, the Labor Department may issue the special permit only if the crop has a particularly short harvesting season and it would cause severe economic disruption of the industry not to use child labor, if the work will not be deleterious to children's health or well-being, if persons over 12 are not available for the work, and if the industry has traditionally employed 10-and 11-year-olds without displacing persons over 16 from job opportunities. Even if all of the above requirements are met, however, the Secretary of Labor may grant the permit only if no pesticides are used in the fields, or if the Secretary finds, after the notice and comment in the *Federal Register*, that there is objective evidence that the pesticides used are safe for children (29 U.S.C. § 213(c)(4); *National Association of Farmworker Organizations v. Marshall*, 628 F.2d 604 (D.C. Cir. 1980)). So far no such permits have been granted.
2. *Children Age 12 and 13* — May work in agriculture only outside local school hours, and only with the consent of their parents, or if their parents are working on the same farm.
3. *Children Age 14 and 15* — May work in agriculture only outside local school hours.
4. *Children Age 16 and Over* — May work in agriculture at any time.

Some kinds of farm jobs have been found and declared by the Labor Department to be especially dangerous. In all such agricultural jobs, no child under the age of 16 may be employed. Jobs of this type include operating high-power tractors, operating or helping to operate cotton and grain harvesting machines, working from a ladder at a height over 20 feet, handling or applying agricultural chemicals, etc.

FLSA is enforced by the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor. This agency can make investigations concerning the employment of children and may take action to prevent employers from unlawfully using child labor. It is also responsible for reviewing farmers' applications for permits to hire 10- and 11-year-old harvest workers and for assuring that jobs offered under such permits are not harmful to the health and well-being of child workers (Motivation Education and Training, Inc., 1979).

Social Security Act

Farm employers (including crew leaders, if they themselves pay the members of their crews and have not been designated in writing as employees of the farmer or farm operator) who pay (or expect to pay) at least $150 in cash farm wages to a particular worker during the year, or who employ the worker in farm labor for at least 20 days for hourly, weekly, or monthly cash wages, are required to take Social Security tax from the farmworker's pay and submit it to the federal government, together with an equal amount of their own money.

Under this law, the employer (whether a farmer or crewleader) must keep a record of each worker for whom Social Security tax is deducted, including the worker's name, Social Security number, total wages paid, and amount of tax deducted from pay. The employer must also prepare a wage and tax statement (Form W-2) for each worker, showing total wages paid during the year and total tax withheld, and send copies of it to each such worker by January 31 of the following year.

Workers who have had Social Security taxes deducted from their pay may be eligible for Social Security payments when they retire or if they become disabled. Their families may claim benefits in the event of the worker's death. Whether or not the worker or his or her family can obtain Social Security benefits, as well as the amount of those benefits, depends on how much and for how long the farmworker and his/her employers have paid into his or her Social Security account while he/she works.

Farmworkers are especially vulnerable to dishonest employers with regard to Social Security contributions because of the method of payment of wages and the migratory nature of their work. Cases have occurred where farmworkers have been disabled and have filed for their rightfully due Social Security benefits only to find that a crewleader or other employer not only did not pay into the Social Security fund, but also that the employer had kept for him- or herself the portion of the farmworker's wages that had supposedly been withheld as Social Security tax. As many as two-thirds of migrant farmworkers who should have been covered by Social Security payments and deductions are victims of employer "nonreporting" or fraud (Schacht et al., 1982).

The Social Security Administration, U.S. Department of Health and Human Services is responsible for administering this law. Any question about benefits and credits to the farmworker's earnings record may be directed to the nearest Social Security office. Farmworkers should request a statement of earnings and taxes from any Social Security Administration office at least every three years. The Internal Revenue Service, U.S. Treasury Department is responsible for collection of Social Security taxes from employers. If a farmworker believes his or her wages have been incorrectly taxed, or that taxes and wages have not been properly reported to the government, he or she should contact the nearest office of the U.S. Internal Revenue Service (Motivation Education and Training, Inc., 1979).

While agricultural workers are covered by the Federal Insurance Contributions Act (FICA) (26 U.S.C. § 3101 *et seq.*), they are still subject to a number of exclusions, e.g., of non-cash payments (26 U.S.C. § 3121(a)(8)(A)) and of cash payments of less than $150 per year or for less than 20 days of work (26 U.S.C. § 3121(a)(8)(B)). Workers who are not taxed under FICA are not eligible for Old Age, Survivors, and Disability Insurance (42 U.S.C. § 409(h) *et seq.*).

Transportation: U.S. Department Of Transportation Act

Except for a worker transporting himself or his immediate family, any person who, in any vehicle except a passenger car or station wagon, transports three or more farmworkers to or from work a distance of at least 75 miles and across state lines must comply with the safety requirements of this law, which include:

1. The driver of any vehicle transporting workers (as described above) must pass a physical examination, be found in adequate physical condition, and carry a doctor's certificate to that effect.
2. Such drivers must be at least 21 years old, be familiar with these rules, be able to communicate in English, and have a valid driver's license.
3. Vehicles must be in good operating condition, all equipment must be properly secured, and passengers and other cargo must be safely distributed.
4. Drivers must provide for meal stops at least every six hours, and for no less than 30 minutes each. Rest stops must occur at least once between each meal stop.
5. Each passenger must be provided with a seat and must be protected from cold and other weather extremes.
6. A person may not drive longer than ten hours (excluding meal and rest stops) within any 24-hour period, unless such driver rests eight consecutive hours immediately following the ten-hour driving period.

This law is enforced by the Bureau of Motor Carrier Safety, Federal Highway Administration, U.S. Department of Transportation.

Migrant And Seasonal Agricultural Worker Protection Act (AWPA)

This law went into effect in April 1983 and takes the place of the Farm Labor Contractor Registration Act. Its provisions include the following:

1. Crewleaders must be licensed by the U.S. Department of Labor.
2. At the time of hiring, migrant farmworkers must be given a written statement in a language they use and best understand, which outlines the working and housing conditions, transportation arrangements, insurance coverage, and whether a strike or labor dispute exists at the workplace.
3. Upon being paid, the migrant farmworkers must be given a written statement detailing wages earned, hours worked, amount withheld and why, and total pay.
4. Each person who furnishes housing to migrant farmworkers is responsible for complying with the applicable Federal, state, or local health and sanitation standards.
5. The job information must be posted at the workplace where everyone can see it.
6. Seasonal farmworkers must be given all of the above only if they request it.
7. Vehicles used for transporting farmworkers must be insured and must meet safety standards.
8. Growers, not just crewleaders, are responsible for complying with worker protections.
9. Farmworkers covered by this law can directly sue most agricultural employers or associations for violations and may recover actual damages or statutory damages of up to $500 for each intentional violation.

Federal and State Enforcement: AWPA is intended to supplement state law, and compliance with AWPA does not excuse any person from complying with appropriate state law. This law is federally enforced by the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor. This agency reviews applications for crewleader certificates and issues certificates to qualified applicants. It can investigate complaints and take action against crewleaders, their assistants, and farm operators who violate the law.

REFERENCES CITED

Center for Rural Affairs: *It's Not All Sunshine and Fresh Air: Chronic Health Effects of Modern Farming Practices*. April 1984. Cost, including postage, is $6.00. Contact: Center for Rural Affairs, Box 405, Walthill, NE 68067.

Federal Register: Notice of decision superseding prior determination not to issue a standard: notice of limited reopening of the rulemaking record. Vol. 50, No. 203, pp. 42660-42663, October 21, 1985.

Federal Register: Intent to Form an Advisory Committee to Negotiate Proposed Farmworker Protection Standards for Agricultural Pesticides. Vol. 50, 182, pp. 38030-38033, September 19, 1985.

Federal Register: Field Sanitation. Final Determination: Statement of reasons. Vol. 50, No. 73, pp. 15086-15092, April 16, 1985.

Federal Register: Field Sanitation. Proposed rule; request for comments. Vol. 49, No. 42, pp. 7589-7605, March 1, 1984.

Migrant Legal Action Program, Inc. and the Farmworker Justice Fund, Inc.: *Post Hearing Proposed Findings of Fact and Conclusions of Law*. Docket No. H-308, U.S. Department of Labor, Occupational Safety and Health Administration in the matter of the proposed farmworker field sanitation standard. August 30, 1984. Available from: Farmworker Justice Fund, Inc., 2001 "S" St., N.W., #312, Washington, D.C. 20009 for $6.00.

Motivation Education & Training, Inc.: *Farmworker Protective Laws: A Guide for Farmworkers in the United States and Puerto Rico*. April 1979. This handbook contains both the English and Spanish versions. Available from : Motivation Education and Training, Inc., Research Office, 55 North IH35, Room 117, Austin, TX 78702 (phone: 512-472-6045).

Schacht, M., Beardall, W., and Bryant, G.B.: Bitter Harvest: The Continuing Exploitation of Farm Labor in the United States, 1974-82. *Hearing on the Migrant and Seasonal Agricultural Worker Protection Act before the Subcommittee on Labor Standards of the Committee on Education and Labor*. U.S. House of Representatives. Ninety-seventh Congress. Second Session on H.R. 7102. Hearing held in Washington, D.C. on September 14, 1982, pp. 65-172. Washington, D.C.: U.S. Government Printing Office, 1983.

XX. Additional Resources

A. State Reports

The following states were contacted to determine whether they had a Governor's advisory commission on migrant and seasonal farmworkers, and if they published reports on farmworker issues: California, Colorado, Delaware, Florida, Illinois, Maryland, Michigan, New Jersey, New York, North Carolina, Ohio, South Carolina, Texas, Virginia, and Washington. Puerto Rico was also contacted.

Some states submit an annual or biannual report to the Governor on the status of their farmworker population. Sometimes these reports are the product of a state agency charged with migrant or Hispanic affairs or with agricultural labor. In other states, the Governor's advisory commission or council publishes this report. Some states do not publish reports but rather make the minutes of the Governor's advisory commission on farmworkers available to the public.

The following list gives the title of state reports and the person or agency to contact for copies. If a state is not listed it either has no Governor's advisory commission or does not publish annual or biannual reports on farmworkers.

Florida

Minutes of meetings of the Governor's Advisory Council on Farmworker Affairs available from:

Mr. Pedro Narezo, III
Governor's Office
State of Florida
Tallahassee, FL 32301
904-488-5911

Maryland

The Governor's Commission on Migratory and Seasonal Farm Labor: *Annual Report to the Governor*. December 31, 1984. For copies, contact:

Ms. Patricia Fields
Executive Director
State of Maryland
Governor's Commission on
Migratory and Seasonal Farm Labor
1123 N. Eutaw Street, Suite 310
Baltimore, MD 21201
301-383-2248

Michigan

Michigan Department of Labor: *Annual Report. Michigan Commission on Agricultural Labor*. Copies available from:

Michigan Department of Labor
Bureau of Employment and Economic
Development
7150 Harris Drive
P.O. Box 30015
Lansing, MI 48909

or contact:

Manuel F. Gonzalez, Director
Office of Migrant Services
State of Michigan
Department of Social Services
300 South Capitol Avenue
P.O. Box 30037
Lansing, MI 48909
517-373-3567

North Carolina

The Farmworker Council was formed in late 1983 and held its first meeting in February, 1984. Minutes of meetings are available from:

Ms. Patricia Yancey
Office of Policy and Planning
116 West Jones Street
Raleigh, NC 27611
919-733-4131

State publications include:

Legislative Research Commission: *Migrant Workers*. Report to the 1983 General Assembly of North Carolina, January 1983. For copies, contact:

Room 2126, 2226
State Legislative Building
Raleigh, NC 27611
919-733-7778
or
Room 500
Legislative Office Building
Raleigh, NC 27611
919-733-9390

Hazards of the Harvest: A Report on Farmworkers' Health in North Carolina to the Legislative Study Commission on Migrant Farmworkers. March 18, 1982. For copies, contact:

Farmworkers Legal Services
of North Carolina
P.O. Box 1229
Raleigh, NC 27602
919-821-5869

Ohio

Ohio Migrant Center Annual Report. For copies, contact:

Joseph B. Nowak
State of Ohio
Department of Agriculture
65 South Front Street
Columbus, OH 43215

South Carolina

The State Migrant Commission no longer submits a formal report to the Governor's office. For information on the Commission's activities, contact:

Mr. Ben Hollis, Chairman or
Ms. Suzette C. Bailey, Secretary
The State Migrant Commission
P.O. Box 11329
Columbia, SC 29211
803-758-3208

Texas

There is a Division of Migrant and Seasonal Farmworkers in the Texas Department of Community Affairs. For information, contact:

Mr. Elario Diaz
Box 13166
Capitol Station
Austin, TX 78711
512-475-0681

Publications:

Texas Department of Agriculture: *Pesticide Safety for Texas*. October 1984. Available from: Texas Department of Agriculture, P.O. Box 12847, Austin, TX 78711.

Texas Rural Legal Aid, Inc.: *Texas State Plan for Farmworkers*. February 1982. Available from: Texas Rural Legal Aid, Inc., 259 S. Texas Street, Weslaco, TX 78596 (phone: 512-968-6575). Cost is $5.00.

Lyndon B. Johnson School of Public Affairs: *Pesticides and Worker Health in Texas*. Policy Research Project Report No. 67, 1984. Available from: L.B.J. School of Public Affairs, The University of Texas at Austin, Austin, TX 78712.

Virginia

The Governor's Migrant and Seasonal Farmworkers Commission submits an annual report to the Governor and to the General Assembly. For copies, contact:

Philip McCaleb, Chairman
Commonwealth of Virginia
Governor's Migrant and Seasonal
Farmworkers Commission
P.O. Box 1358
Richmond, VA 23211
804-442-6187

B. Other Resources

This section lists books, government reports, newsletters, slide shows, and other health education materials on farmworker health and related issues that, with a few exceptions, have not previously been cited in the body of this report. After the first two subsections ("general" and "occupational health") the topics follow the order of the table of contents and are marked accordingly.

General

Dement, E.F.: *Out of Sight, Out of Mind: An Update on Migrant Farmworker Issues in Today's Agricultural Labor Market*. Prepared for the National Governors' Association, Washington, D.C. Final version, August 1985. Available from Mr. Fernando L. Alegria, Jr., National Governors' Association, 444 North Capitol St., Washington, D.C. 20001 (phone: 202-624-5300) for $10.00.

Goldfarb, R.L.: *Migrant Farm Workers: A Caste of Despair*. Ames, IA: The Iowa State University Press, 1981.

Hintz, J.: *Poverty, Prejudice, Power, Politics: Migrants Speak about Their Lives*. Columbus, OH: Avonelle Associates, 1981.

Johnston, H.: *Health for the Nation's Harvesters: A History of the Migrant Health Program in its Economic and Social Setting*. Farmington Hills, MI: National Migrant Workers Council, Inc., 1985. Available from: N.M.W.C., Inc., Editorial Office, 617 W. Wayne St., South Bend, IN 46625 for $8.95.

InterAmerica Research Associates: Annotated Bibliography on Migrant Farmworker Issues. September, 1979. Contact: David Cavenaugh, National Association of Community Health Centers, Inc., 1625 "I" St. N.W., Suite 420, Washington, D.C. 20006 (phone: 202-833-9280).

Koos:, E.L.: *They Follow the Sun*. Florida State Board of Health, Monograph No. 1, 1957, Jacksonville, Florida.

Legator, M.S., Harper, B.L., and Scott, M.J. (eds.): *The Health Detective's Handbook: A Guide to the Investigation of Environmental Health Hazards by Nonprofessionals*. Baltimore: The Johns Hopkins University Press, 1985.

Majka, L.C. and Majka, T.J.: *Farm Workers, Agribusiness, and the State*. Philadelphia: Temple University Press, 1982.

National Migrant Referral Project, Inc.: *Migrant Health Newsline*. Bimonthly newsletter published by: National Migrant Referral Project, Inc., 2512 South IH 35, Suite 220, Austin, TX 78704 (phone: 800-531-5120 or 512-447-0770; 800-252-9446 in Texas).

National Migrant Referral Project, Inc.: *Migrant Health Referral Directory*, April 1985. Available from: National Migrant Referral Project, Inc., 2512 South I.H. 35, Suite 220, Austin, TX 78704 (phone: 512-447-0770, 800-531-5120 or 800-252-9446 in Texas).

Schmitt, Raymond: *The Migrant Farmworker Situation in the U.S.: The Problems and the Programs*. Washington, D.C.: The Library of Congress, Congressional Research Service, Education and Public Welfare Division, April 17, 1975.

Sosnick, S.H.: *Hired Hands: Seasonal Farm Workers in the United States*. Santa Barbara: McNally & Loftin, West, 1978.

Project MERLIN (Migrant Education Resource List and Information Network) is a computerized reference service for migrant education and migrant health personnel which is administered by the Pennsylvania Department of Education and funded by the U.S. Department of Education, Office of Migrant Education. For more information, contact:

Project MERLIN
Pennsylvania Department of Education
333 Market Street
Harrisburg, PA 17108
717-783-7121

Occupational Health

Interagency Education Program Liaison Group: *Environmental Health-Related Information: A Bibliographic Guide to Federal Sources for the Health Professional*. Prepared by Technical Resources, Inc., Bethesda, Maryland, 1984. Available from: National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161 for $25.00.

Levy, B.S. and Wegman, D.H. (eds.): *Occupational Health: Recognizing and Preventing Work-Related Disease*. Boston: Little, Brown and Company, 1983.

National Institute for Occupational Safety and Health: *A Pocket Guide to Chemical Hazards* Publication No. 78-210, Washington, D.C: U.S. Government Printing Office, 1978. Available in English and Spanish.

National Institute for Occupational Safety and Health: *Occupational Diseases: A Guide to Their Recognition*. Revised edition. Washington, D.C.: U.S. Government Printing Office, June 1977.

Office of Technology Assessment: *Preventing Illness and Injury in the Workplace*. Washington, D.C.: U.S. Congress, Office of Technology Assessment, OTA H-256, April 1985. Available from U.S. Government Printing Office.

Proctor, N.H. and Hughes, J.P.: *Chemical Hazards of the Workplace*. Philadelphia: Lippincott, 1978.

Shapiro, S. and Foster, D.: *Hazards to Agricultural Workers*. September 1980. Published by Arizona Center for Occupational Safety and Health, 1145 N. Warren Avenue, Tucson, AZ 85724 (phone: 602-626-7900).

U.S. Department of Labor: *Occupational Safety and Health: A Bibliography*. Washington, D.C.: U.S. Department of Labor, Office of the Assistant Secretary for Administration and Management, 1978.

Zenz, C. (ed.): *Occupational Medicine: Principles and Practical Applications*. Chicago: Year Book Medical Publishers, Inc., 1975.

IV. Farmworker Demographics

HCR: *Methodology for Designating High Impact Migrant and Seasonal Agricultural Areas*. 1985. Study prepared by HCR, 2021 L Street, N.W., Washington, D.C. 20036 for the Office of Migrant Health, Parklawn Building, Room 7A-55, 5600 Fishers Lane, Rockville, MD 20857 (phone: 301-443-1153).

Okada, Y., Richards, M., and Slesinger, D.P.: *Migrant Worker Studies: A Critical Review of Methodologies*. Madison, WI: Center for Demography and Ecology, The University of Wisconsin-Madison. CDE Working Paper 82-33, June 1982. Contact: Dr. Doris P. Slesinger, Dept. of Rural Sociology, University of Wisconsin-Madison, 1450 Linden Drive, Madison, WI 53706 (phone: 608-262-1510).

Slesinger, D.P. and Okada, Y.: Fertility Patterns of Hispanic Migrant Farm Women: Testing the Effect of Assimilation. *Rural Sociology* 49(3):430-440, Fall 1984.

Whitener, L.A.: The Migrant Farm Work Force: Differences in Attachment to Farmwork. *Rural Sociology* 50(2):163-180, 1985.

Whitener-Smith, L.: *Social and Economic Characteristics of Spanish Origin Hired Farmworkers in 1973*. U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 349. Washington, D.C.: U.S. Government Printing Office, September 1976.

V. Health Status of Farmworkers/Utilization of Health Services

Browning, R.H. and Northcutt, T.J., Jr.: *On the Season: A report of a public health project conducted among Negro migrant agricultural workers in Palm Beach County, Florida*. Florida State Board of Health, Monograph No. 2, 1961.

O'Brien, M.E.: Reaching the Migrant Worker. *American Journal of Nursing* 83(6):895-897, 1983.

Shenkin, B.N.: *Health Care for Migrant Workers: Policies and Politics*. Cambridge, MA: Ballinger Publishing Company, 1974.

Slesinger, D.P. and Richards, M.: Folk and Clinical Medical Utilization Patterns among Mexicano Migrant Farmworkers. *Hispanic Journal of Behavioral Sciences* 3(1):59-73, 1981.

U.S. Department of Health and Human Services: *Selected Health Characteristics by Occupation*. United States, 1975-76. Data from the National Health Survey Series 10 No. 133. DHHS Publication No. (PHS) 80-1561. Hyattsville, MD: National Center for Health Statistics, May 1980.

VII. Communicable Diseases

Cooper, J.K.: *Caribbean Medical Problems in the United States: A Review of Tropical and Other Diseases of Visitors to and Immigrants from the Caribbean*. Lexington, KY: University of Kentucky, 1984. For copies, contact: Patricia President, National Clearinghouse for Primary Care Information, 1555 Wilson Blvd., Suite 600, Rosslyn, VA 22209 (phone: 703-522-0870).

A 12-min. VHS training videotape for farmworker health care providers on parasitic infections has been produced by the Farmworker Health Advocacy Project of North Carolina. For more information, contact:

Joseph "Chip" Hughes
East Coast Farmworker Support Network
P.O. Box 1633
Raleigh, NC 27602
919-983-3414

Water Quality

McJunkin, F.E.: *Water and Human Health*. Washington, D.C.: National Demonstration Water Project, 1982. Produced for and available through: Development Information Center, Agency for International Development, Washington, D.C. 20523.

National Demonstration Water Project: *Guide to Water Quality Problems and Solutions*. November 1983. Available from: National Demonstration Water Project, 1725 DeSales St., N.W., Suite 402, Washington, D.C. 20036 (phone: 202-659-0661).

National Demonstration Water Project: *Safe Water and Waste Disposal for Rural Health: A Program Guide*. Washington, D.C. 1982. Prepared for and available from: Development Information Center, Agency for International Development, Washington, D.C. 20523.

X. Pesticides

Slide shows/Videotapes

1. The U.S. Environmental Protection Agency in conjunction with the Institute of Food and Agricultural Sciences of the University of Florida issued two training packets in November 1983 — one for farmworkers, the other for non-certified pesticide mixers, loaders, and applicators. These training packets include a leaders' guide, slide shows divided into three parts with audiocassettes (both Spanish and English portions have the audible and inaudible beep/pulse), and laminated cards for use by the trainees.

   The Farmworkers' Pesticide Safety Program is divided into three parts:
   I. Introduction and Label (approx. 10 min.)
   II. First Aid and Prevention (13 min.)
   III. Daily Living with Pesticides (8 min.)

   The program called "Pesticide Safety for Non-Certified Mixers, Loaders, and Applicators" has three parts:
   I. Formulations, Label, Clothing (12 min.)
   II. Safety Measures (9 min.)
   III. Disposal and Transportation (9 min.)

   Distributed by: University of Florida
   IFAS - Bldg. 664
   Gainesville, FL 32611

   Cost: $42 for each training program
   $52 for each set of instructional materials (laminated cards for 15 participants)

   The EPA may be able to give some sets to farmworker/community organizations *gratis*. For further information, contact Ms. Carole Parker, Farm Safety Program, U.S. EPA, TS-757C, 401 M St., S.W., Washington, D.C. 20460 (703-557-7666).

2. Pesticides: A Guide for Farmworkers (National version)

   15-min. slide show. Audiocassette has Spanish version on one slide, English on the other. Transcript shows where to advance slides. Set of Spanish and English titled slides.

   Show discusses the uses of pesticides, how poisoning of farmworkers occurs, symptoms of pesticide poisoning, workers' compensation, federal pesticide laws, and workers' rights.

Target Audience:	Farmworkers, community organizations serving farmworkers, persons interested in farmworker issues.
Distributed by:	California Institute for Rural Studies P.O. Box 530 Davis, CA 95617 916-756-6555
Cost:	$85.00 plus $3.00 postage; $20 for one-month rental: $60 refundable deposit required. Recipient must pay postage both ways. There is also a version of this slide show that is specific to California.

3. Pesticidas, Una Historia de Peligro (Pesticides: A Story of Danger).

   First in a series of five videotapes focusing on issues related to farmworkers and pesticides, using farmworkers as actors. It depicts farmworkers with symptoms of pesticide exposure approaching the crewleader, going to a health clinic, and learning about the dangers of being exposed to pesticides. It outlines symptoms of exposure, describes procedures for cleaning after contact with chemicals, and reviews risks to children and pregnant women. The overriding theme is that victims of exposure should seek medical attention for treatment, and that they should document their exposure. (19 mins.)

Produced by Jaime E. Garza, Health Educator, Hidalgo County Health Care Corporation, Pharr, TX, in conjunction with an advisory committee composed of representatives from HCHCC, the Texas Department of Health, Texas Rural Legal Aid and Su Clinica Familiar of Harlingen, Texas.

Distributed by: Mr. Jaime E. Garza
Hidalgo County Health Care Corporation
P.O. Drawer Q
Pharr, Texas 78577
(512) 383-4985

Cost: Cost of reproducing the tape, plus postage.

4. A 12-min. VHS training videotape for farmworker health care providers on the recognition and treatment of pesticide poisonings has been produced by the Farmworker Health Advocacy Project in North Carolina. For more information, contact:
   Joseph "Chip" Hughes
   East Coast Farmworker Support Network
   P.O. Box 1633
   Raleigh, NC 27602
   919-983-3414

5. Project TEACH (Teaching Environmental Awareness to the Children of Harvest) has produced a videotape on pesticides ("Pebbles in the Pond"). In addition, they have curriculum units for migrant farmworker children from pre-kindergarten to grade six for teaching correct practices to avoid pesticide exposure.

   For more information, contact:
   Project TEACH
   Pennsylvania Department of Education
   333 Market Street
   Harrisburg, PA 17108
   717-783-7093

6. Pesticide Poisonings and Injuries: Where, When and How (A Self-Instructional Presentation)

   26-min. slide show. Comes with booklet with pre- and post-tests and answers, text of the cassette, and suggested reading list.

   History of development of pesticides, classification of types of pesticides, adverse health and other effects of pesticides, epidemiology of pesticide poisonings, range of toxicity of pesticides, and chemical classes largely responsible for poisonings. Routes of pesticide absorption into the body, outline of occupations involved with the manufacturing, distribution, and use of pesticides, and specific risks of each occupation. Techniques for preventing poisonings. Self-test requiring analysis of four pesticide poisoning cases.

   Target audience: Physicians, nurses, medical and nursing students, other health professionals/scientists.

   Distributed by: National AudioVisual Center
   General Services Administration
   Order Section/MM
   Washington, DC 20409
   800-638-1300 (toll free)
   local number: 301-763-1891

   Cost: $44 (not for rent)

7. Toxicology of Cholinesterase-Inhibiting Insecticides

   21-min. slide show. Comes with booklet with pre- and post-tests and answers, text of the cassette, and suggested reading list.

   The following characteristics of the cholinesterase-inhibiting organophosphates and carbamate insecticides are discussed: typical uses; physical and chemical properties; relative toxicities of various compounds; mechanism of toxic action in humans; "muscarinic," "nicotinic," and "central" symptoms and signs of poisoning; problems faced when diagnosing poisonings; three laboratory methods of poisoning confirmation and inadequacies associated with each method; treatment and prevention of these poisonings.

   Target audience: Physicians, nurses, medical and nursing students, other health professionals/scientists.

   Distributed by: National AudioVisual Center
   General Services Administration
   Order Section/MM
   Washington, D.C. 20409
   800-638-1300 (toll free)
   301-763-1891

   Cost: $39 (not for rent)
   Note: There are two other pesticide slide shows in the National AudioVisual Center's Rural Health Series. They are entitled: "Toxicology of Commonly Used Herbicides" and "Toxicology of Fungicides, Rodenticides, and Fumigants" and are available from the above address.

8. Stopping the Pesticide Treadmill

   20-min. slide show with companion 14-page study guide. (English only).

   Describes some of the problems associated with pesticides and what people in the rural community are doing to solve them.

   Target Audience: General public

   Distributed by: California Institute for Rural Studies
   P.O. Box 530
   Davis, CA 95617
   916-756-6555

Cost: $75.00 plus $3.00 postage

Rental cost: $20 for one-month rental. Must submit $60 refundable deposit and pay postage both ways. Study guides 50¢ each with discounts available for bulk orders.

Books/Manuals

California Department of Food and Agriculture: *Worker Health and Safety Unit: Pesticide Safety Information Series*. Sacramento, CA, 1981. (Division of Pest Management, Environmental Protection, and Worker Safety, California Dept. of Food and Agriculture, 1220 N Street, Sacramento, CA 95814.) Available in English and Spanish.

California Institute for Rural Studies: *Pesticides: A Guide for Farmworker Agencies*. Davis, CA, 1983. Available from CIRS, P.O. Box 530, Davis, CA 95617 (916-756-6555) for $7.50 plus $1.50 postage.

Davies, E., Freed, V.H., and Whittemore, F.W. (eds.): *An Agromedical Approach to Pesticide Management: Some Health and Environmental Considerations*. Miami: The University of Miami, 1982. For more information, contact: John E. Davies, M.D., Department of Epidemiology (R669), University of Miami, School of Medicine, P.O. Box 016069, Miami, FL 33101.

Echobichon, D.J. and Joy, R.M.: *Pesticides and Neurological Diseases*. Boca Raton, FL: CRC Press, 1982.

Farm Chemicals Handbook. Published annually by Meister Publishing Co., 37841 Euclid Avenue, Willoughby, OH 44094. Cost for 1986 edition: $46.00.

Hallenbeck, W.H. and Cunningham-Burns, K.M.: *Pesticides and Human Health*. New York: Springer-Verlag, 1985. (This book documents acute and chronic health effects from some 200 active and inert pesticide ingredients.)

Hayes, W.J., Jr.: *Pesticides Studied in Man*. Baltimore: Williams and Wilkins Company, 1982.

Hayes, W.J., Jr.: *Toxicology of Pesticides*. Baltimore: Williams and Wilkins Company, 1975.

Interagency Pesticide Training Coalition: *Pesticide Training: Continuing Education Seminar for Health Personnel*. (Draft). Contact: Molly Coye, M.D., M.P.H., Governor's Office of Policy and Planning, State House, Room 232, Trenton, NJ 08625 (phone: 609-292-6000).

LaBarre, K.: *Physician's Guide to Management of Pesticide-related Illnesses (Monterey County)*. Stockton, CA: Agricultural Workers' Health Centers, Inc., 1983. Address: 230 North California Street, Stockton, CA 95202.

Mott, L.: *Pesticides in Food: What the Public Needs to Know*. San Francisco: Natural Resources Defense Council, Inc., March 1984. Copies available from: Natural Resources Defense Council, Inc., 25 Kearny St., San Francisco, CA 94108 (phone: 415-421-6561).

Texas Department of Agriculture: *Pesticide Safety for Texas*. A Report of the Texas Department of Agriculture, October 1984. Available from: Texas Department of Agriculture, P.O. Box 12847, Austin, TX 78711.

U.S. Department of Health, Education and Welfare: *Proceedings: Pesticide Residue Hazards to Farm Workers*. HEW Publication No. (NIOSH) 76-191. Washington, D.C.: U.S. Government Printing Office, May 1976.

Wasserstrom, R. and Wiles, R.: *Field Duty: U.S. Farmworkers and Pesticide Safety*. Study #3. Washington, D.C.: World Resources Institute, July 1985. Available for $3.50 from: World Resources Institute, 1735 New York Ave., N.W. Washington, D.C. 20006.

XI. Dermatitis

Emmett, E.A.: The Skin and Occupational Diseases. *Archives of Environmental Health* 39(3):144-149, 1984.

XIV. Accidents

U.S. Department of Health, Education, and Welfare: *NIOSH Health and Safety Guide for Farm and Garden Machinery and Equipment Manufacturers*. HEW Publication No. (NIOSH) 75-119. Washington, D.C.: U.S. Government Printing Office, November, 1975.

Migrant Clinic Materials

North County Health Services, San Marcos, CA, has produced a Childhood Accident Prevention Program (CAPP) package of health education materials in Spanish and English. CAPP was developed to teach how to prevent childhood injuries and what to do when they occur. The package includes curriculum guides, a syllabus, and safety sheets. North County also has bilingual health education materials and training modules on infant growth and development for the prevention of child abuse and neglect. For more information, contact:

Ms. Irma Cota
North County Health Services
348 Rancheros Drive
San Marcos, CA 92069
619-471-2100

United Health Centers of San Joaquin Valley, Inc., Parlier, CA, has produced a series of videotapes on farmworker safety issues, such as preventing accidents and injuries to the lower back, upper respiratory ailments due to pesticides and dust, and arthritis from working in the rain.

UHC also publishes a monthly bilingual newsletter, *Blueprint for Better Health/Diseño Para Mejor Salud*, which periodically contains articles on farmworker safety. For more information, contact:

Mr. Jesus Sánchez
Video Programming Project Coordinator
and Marketing Representative
United Health Centers
650 Zediker Avenue
Parlier, CA 93648
209-646-3561

Farm Safety Training Materials

Farm machinery manufacturers and organizations such as the National Safety Council, Inc. produce training materials on occupational safety, generally for employers.

1. John Deere
   Deere & Company
   John Deere Road
   Moline, IL 61265
   309-752-8000

   Puts out catalog "Teaching Materials from John Deere." Some of films and videotapes have Spanish or other language versions.

2. International Harvester
   P.O. Box 4521
   Oak Brook, IL 60521
   312-887-2233

   One of their films, "Tractor Safety Is No Accident" is available for loan free of charge from:
   Grange Film Foundation
   1616 H Street, N.W.
   Washington, D.C. 20006
   202-628-3507

   The film covers operation and maintenance of the tractor by a farmer. Includes some graphic reenactments of actual accidents and interviews with farm accident victims.

3. The National Safety Council issues a kit for observance of National Farm Safety Week (the third week in September). The Council also has a series of safety bulletins and other publications. Contact:
   National Safety Council
   Farm Department
   444 North Michigan Avenue
   Chicago, Illinois 60611
   312-527-4800

XVI. Cancer

Schottenfeld, D.: Chronic Disease in the Workplace and Environment: Cancer. *Archives of Environmental Health* 39(3):150-157, 1984.

XVII. Maternal and Child Health Hazards

Reproductive Hazards

Infante, P.F. and Legator, M.S. (eds.): *Proceedings of A Workshop on Methodology for Assessing Reproductive Hazards in the Workplace*. April 19-22, 1978. Washington, D.C.: U.S. Government Printing Office, 1980.

Kurzel, R.B. and Cetrulo, C.L.: The Effects of Environmental Pollutants on Human Reproduction, including Birth Defects. *Environmental Science and Technology* 15(6):626-639, 1981.

Legator, M.S., Rosenberg, M.J., and Zenick, H. (eds.): *Environmental Influences on Fertility, Pregnancy, and Development: Strategies for Measurement and Evaluation*. New York: Alan R. Liss, Inc., 1984. (Also published as Vol. 4, No. 1 of the journal *Teratogenesis, Carcinogenesis, and Mutagenesis*, 1984.)

Lockey, J.E., Lemasters, G.K., and Keye, W.R., Jr. (eds.): *Reproduction: The New Frontier in Occupational and Environmental Health Research. Progress in Clinical and Biological Research*, Vol. 160. New York: Alan R. Liss, Inc., 1984.

Roan, C.C., Matanoski, G.E., McIlnay, C.Q., et al.: Spontaneous Abortions, Stillbirths, and Birth Defects in Families of Agricultural Pilots. *Archives of Environmental Health* 39(1): 56-60, 1984.

Child Health

American Academy of Pediatrics: 1985 Publications Catalogue, Free. Available from: American Academy of Pediatrics, Publications Department, P.O. Box 927, Elk Grove Village, IL 60007, (800-433-9016). Request *1985 Publications Catalog*, XX0001, and enclose a self-addressed mailing label.

Cavenaugh, D.N., Lynch, L.J., Porteous, S.M., et al.: *Migrant Child Welfare: A State of the Field Study of Child Welfare Services for Migrant Children and Their Families Who Are In-Stream, Home Based, Or Settled-Out*. Three volumes: Executive Summary, Final Report, and A Review of the Literature and Legislation. DHEW Publications No. (OHDS) 78-30117. Prepared by InterAmerica Research Associates, Washington, D.C., June 1977.

Dorman, R. and Rollo, K. (eds.): *Preventing Child Abuse in the Harvest: A Handbook for Migrant Educators*. 1985. Contact: ESCAPE (Eastern Stream Child Abuse Prevention and Education), Family Life Development Center, Department of Human Development and Family Studies, New York State College of Human Ecology, Cornell University, Ithaca, NY 14853.

Migrant Student Record Transfer System (MSRTS)

A nationwide network of communication centers that collects, stores, and transmits health and academic records of more than 700,000 children of migrant farmworkers and fishing workers in the U.S. and Puerto Rico, is maintained by the Office of Migrant Education, U.S. Department of Education. The central computer is based at the University of Arkansas in Little Rock. The system, which was established in 1969, provides health and educational records of migrant children to migrant education personnel.

Health data included in a child's record include results of physical exams, inoculations, dental information, and special health conditions (e.g., anemia, positive TB test, hearing or vision limitations). These health data are available to migrant health care providers through the National Migrant Referral Project, Inc., Austin, TX.

For more information, contact:

Mr. Vernon ("Buzz") Grannon (Health Manager)
Arch Ford Education Building
Capitol Mall
Little Rock, AR 72201
501-371-7755
or
Ms. Tomasa Sandifer
National Migrant Referral Project, Inc.
2512 South I.H. 35, Suite 220
Austin, TX 78704
512-447-0770
800-531-5120
800-252-9446 in Texas

Project HAPPIER (Health Awareness Patterns Preventing Illnesses and Encouraging Responsibility). This project is administered by the Pennsylvania Department of Education and funded by the U.S. Department of Education, Office of Migrant Education. Project HAPPIER coordinates an intra/interstate and intra/interagency effort to develop and disseminate curriculum units on health-promoting practices for migrant children. For more information, contact:

Project HAPPIER
Pennsylvania Department of Education
333 Market Street
Harrisburg, PA 17108
717-783-7977

Stockburger, C.: Child Labor in Agriculture: "I hate to pick beans, but I gotta earn my livin'." *Inequality in Education* No. 21, pp. 25-32, June 1976. Volume entitled "Migrant Education." Published by the Center for Law and Education, Harvard University, Larsen Hall, 14 Appian Way, Cambridge, MA 02138.

XVIII. Other Factors Affecting Farmworker Health

Nutrition

Kaufman, M., Lewis, E., Hardy, A.V., et al.: *Families of the Field: Their Food and Their Health.* Report of Florida Migrant Nutrition Project. Florida State Division of Health. Monograph No. 13, 1973.

Whitener-Smith, L. and Rowe, G.: *Food Stamp Participation of Hired Farm Worker Families.* U.S. Department of Agriculture, Economic Research Service, Agricultural Economic Report No. 403. Washington, D.C.: U.S. Government Printing Office, 1978.

Medical Conditions

Hanis, C.L., Ferrell, R.E., Tulloch, B.R., et al.: Gallbladder Disease Epidemiology in Mexican Americans in Star County, Texas. *American Journal of Epidemiology* 122(5):820-829, 1985.

Stern, M.P., Rosenthal, M., Haffner, S.M., et al.: Sex Difference in the Effects of Sociocultural Status on Diabetes and Cardiovascular Risk Factors in Mexican Americans: The San Antonio Heart Study. *American Journal of Epidemiology* 120(6):834-851, 1984.

XIX. Occupational Safety and Health Laws

Davis, E.S. and Wilk, V.A.: *Toxic Chemicals: The Interface between Law and Science.* Washington, D.C.: Farmworker Justice Fund, Inc., 1982. Available from Farmworker Justice Fund, Inc., 2001 "S" St., N.W. #312, Washington, D.C. 20009 (phone: 202-462-8192).

Hunt, V.: The Emergence of the Worker's Right to Know Health Risks. In: *Strategies for Public Health* (L.K.Y. Ng and D.L. Davis, eds.). New York: Van Nostrand Reinhold, 1981.

Appendix I

Public Health Service
Memorandum

DEPARTMENT OF HEALTH & HUMAN SERVICES
HEALTH RESOURCES AND SERVICES ADMINISTRATION
BUREAU OF HEALTH CARE DELIVERY AND ASSISTANCE

Date July 10, 1985

From Director
Migrant Health Program (MHP)

Subject 1985-1986 Interagency Agreement with Environmental Protection Agency (EPA)

To Directors
Division of Health Services Delivery
Regions I-X

The EPA and the Bureau of Health Care Delivery and Assitance (BHCDA), MHP, have just signed this year's Interagency Agreement.

This Agreement offers the Migrant Health Centers (MHC) consultation and laboratory services on health effects related to hazardous exposures to pesticides and lead on the farmworker population. Highlights of the agreement include:

1. A toll free 24-hour number for diagnostic and treatment consultation on pesticide poisoning
2. Laboratory services on request for:
    a. Confirmation of pesticide poisoning
    b. Determination of blood lead levels
3. Training of MHCs medical personnel on:
    a. Pesticide exposure management
    b. Lead exposure management
    c. Other related training
4. Charts of geographic-specific profiles on major local crops and pesticides utilization information

Your cooperation in encouraging the MHCs to promptly report pesticide exposure cases and utilize the services outlined in the Agreement is greatly appreciated. A copy of the Agreement must be mailed to all MHCs in your regions. Should you have any questions concerning the EPA Agreement, please contact Mrs. Sonia M. Leon Reig, Deputy Director, MHP, Room 7A55, 5600 Fishers Lane, Rockville, Maryland 20857. Her telephone number is 301-443-1153.

Billy M. Sandlin

Attachment

INTERAGENCY AGREEMENT
BETWEEN
ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDE PROGRAMS
AND
DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
HEALTH RESOURCES AND SERVICES ADMINISTRATION
BUREAU OF HEALTH CARE DELIVERY AND ASSISTANCE

Protection of Migrant and Seasonal Farmworkers from Health Effects Related to Pesticides

I. *Purpose*

The purpose of this interagency agreement is to provide a framework for mutual cooperation between the Environmental Protection Agency (EPA), Office of Pesticide Programs and the Health Resources and Services Administration, Bureau of Health Care Delivery and Assistance (BHCDA), Migrant Health Program, to protect migrant and seasonal farmworkers from health effects related to pesticides. This agreement will be accomplished by the provision of staff training, training materials and support services to Migrant Health Centers (MHC) and clinics serving farmworkers.

II. *Authority*

This agreement is entered into under authority of section 601 of the Economy Act of 1932, as amended (31 U.S.C. 1535).

III. *Scope of Work*

The EPA Office of Pesticide Programs will utilize the staff and services of its National Pesticide Hazard Assessment Program (NPHAP) to provide Migrant Health clinics consultative, laboratory, and personnel services at the clinics to better identify and manage pesticide poisonings among farmworkers. The clinics will maintain a record of all pesticide related incidents and notify designated NPHAP personnel as they occur. It is expected that a number of opportunities will develop under this agreement which will be of benefit to the farmworker populations served by EPA and BHCDA. These opportunities will be pursued together where possible.

A. The following activities will be carried out by EPA:

(1) The EPA maintains the National Pesticide Telecommunication Network (NPTN) and will make available to Migrant Health Clinics a toll free 24-hour number for use by physicians and medical providers in obtaining assistance in the diagnosis and treatment of pesticide poisoning. All other services provided under the IAG should be obtained via this number. The number and its location will be provided to all clinics. The EPA will report annually to BHCDA the number of requests for assistance by the clinics.

(2) The EPA will provide laboratory services on request to confirm pesticide poisoning. Blood and urine samples taken from clinic patients exposed to pesticides will be shipped to a designated laboratory. The laboratory will perform appropriate biochemical or residue analysis to confirm exposure to pesticides. Clinics will be notified immediately of any finding considered as adverse to the health of a specimen donor. The EPA agrees to process up to 100 samples. Clinics will provide their own sample bottles initially. EPA will replenish the sample bottles to the clinics as they are used and pay for the cost of mailing samples. The EPA will report annually to BHCDA the number of samples received from the clinics.

(3) The EPA will provide laboratory services on request to determine Erythrocyte Protoporphrin (EP) and blood lead levels in migrant children. The EPA agrees to process up to 320 samples. The EPA will provide sample bottles, complete with mailing jackets and preaddressed franked labels and sampling instructions for use by the clinics. Clinics will be notified immediately of any finding considered as adverse to the health of a specimen donor. The EPA will report annually to BHCDA the number of samples received from the clinics.

(4) The EPA will provide direct training to medical personnel under a schedule to be developed in concert with BHCDA. EPA in conjunction with BHCDA's Migrant Health Program will conduct a needs assessment of clinic administrators and health providers of Migrant Health Centers to develop a pesticide training course for health providers of MHC.

(5) The EPA will provide direct training to medical personnel under a schedule to be developed in concert with BHCDA. The training is to include, but not be limited to:

(a) Diagnostic and management information

(b) Treatment and follow-up procedures

(c) Reporting procedures

(6) The EPA will hire a physician under its Cooperative Agreement with Texas Tech. University. This individual will work with the NPTN and also provide new depth as a medical consultant to field studies of migrant workers. Note: Funds are already on hold for this individual ($70,000) at EPA from previous IAG.

(7) Prepare and submit to BHCDA's MHC charts with profiles for specific geographic areas where Migrant Health clinics are based. These charts must include a listing of major local crops (particularly those utilizing manual labor), pesticides usually applied to each crop, and month(s) of application. These charts are to be developed in conjunction with the training sites and are to be used in the training courses for pesticide under item 4 of this section.

B. *The following activities will be carried out by BHCDA:*

(1) The BHCDA will encourage clinic participation in the reporting of pesticide incidents. Pesticide incidents should be reported to the NPTN and appropriate information pertaining to the incident provided at that time. The Migrant Health clinics should report incidents immediately upon recognition in case EPA elects to investigate.

(2) The BHCDA may be requested by the EPA to participate in the EPA national studies of a monitoring or health effects nature. The BHCDA agrees to assist the EPA in obtaining clinic participation and cooperation in this effort.

C. *Reports*

Reports will be required as outlined in III, Scope of Work above.

D. *Project Officers*

Mr. Frank L. Davido FTS 557-0576
Exposure Assessment Branch
Environmental Protection Agency
1921 Jefferson Davis Highway
Crystal Mall #2
Room 807B
Arlington, Virginia 22202

Mrs. Sonia M. Leon Reig FTS 443-1153
Deputy Director of Migrant Health
Bureau of Health Care Delivery and Assistance
Room 7A55, Parklawn Building
5600 Fishers Lane
Rockville, Maryland 20857

IV. *Period of the Agreement*

This agreement shall be effective for 3 years from October 1, 1983. The agreement will be renewed annually and will be contingent upon program needs, the availability of funds and subject to the annual evaluation and approval of both parties. Renewal is subject to the terms of Section VI.

V. *Funds* *EPA Reimbursable Account Number: 4X6B32C001*

The total estimated annual cost for implementation of the tasks and services described under III. Scope of Work for Fiscal Year (FY) 1985 is $100,000 of which the EPA will provide $50,000 and the BHCDA $50,000. Should actual cost for implementation of the agreement exceed $100,000, the EPA will provide services only until the $100,000 has been expended. The EPA will request payment of the BHCDA share by SF 1081 under the following account information:

Appropriation Number: 7550350
Allowance Number: 5-25221
CAN Number: 5-3980004
Object Class: 25.11

Billing Address:
Bureau of Health Care
Delivery and assistance
Office of Financial Management
5600 Fishers Lane, Room 78A09
Rockville, Maryland 20857

VI. *Modification/Cancellation Provision*

This agreement may be renewed, modified by mutual agreement of the parties, or cancelled by 30 day advance written notice by either party. All commitments of funds made prior to modification or cancellation shall be irrevocable.

____________________ Date ________
Edward D. Martin, M.D.
Assistant Surgeon General
Director
Bureau of Health Care
Delivery and Assistance

____________________ Date ________
Steven Schatzow
Director, Office of Pesticide
Programs
Environmental Protection
Agency

Appendix II

J.D. Adams 5/21/82
last revised 10/31/85

LIST OF PESTICIDES HAVING REENTRY INTERVALS

	Federal Standards in Days (crops)	*California Standards in Days*	*Texas Standards in Days*
1. Azinphos-methyl (Guthion)	1	1 - 30	2
2. Carbofuran (Furadan)	14 (sweet and seed corn)	—	—
3. Carbophenothion (Trithion)	2	2 - 14	2
4. Carbosulfan (Advantage)	—	7	—
5. Chlorpyrifos	1 4 (citrus, grapes, peaches)	2	—
6. Demeton (Systox)	2	2 - 7	2
7. Dialifor (Torak)	—	75	—
8. Diazinon	—	5	—
9. Dicrotophos (Bidrin)	2	2	2
10. Dimethoate (Cygon)	—	4	—
11. Dioxathion (Delnav)	—	1 - 30	—
12. Disulfoton	—	2	2
13. Endosulfan (Thiodan)	—	2	2
14. Endrin	2	2	2
15. EPN	1	2 - 14	—
16. Ethion	1	2 - 30	2
17. Fosetyl (Aliette)	7 (hops)	—	—
18. Imidan	—	2 - 5	—
19. Malathion	—	1	—
20. Methidathion (Supracide)	—	2 -30	2
21. Methiocarb (Mesurol)	—	7	—
22. Methomyl (Lannate, Nudrin)	—	1 - 2	—
23. Mevinphos (Phosdrin)	2 - 4*	2 - 4	2
24. Monocrotophos (Azodrin)	2	2	2
25. Naled (Dibrom)	—	1	—
26. Oxamyl (Vydate)	—	1 - 2	—
27. Oxydemeton-methyl (Metasystox-R)	2	2	2
28. Parathion-ethyl (parathion)	2	2 - 60	7
29. Parathion-methyl (methyl-parathion)	2	2 - 21 (21 for encapsulated)	2
30. Phorate (Thimet)	—	2	2
31. Phosalone (Zolone)	1	7	—
32. Phosphamidon (Dimecron)	—	2 - 14	2
33. Propargite (Omite)	7 (grapes)	7	—
34. Sulfur	—	1	—
35. TEPP	—	2 - 4	—
XXX All pesticides in Toxicity Category I	—	1	1

*** Proposed but not implemented yet**

Prepared by James D. Adams, TS-769C, Hazard Evaluation Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, 401 M Street, S.W., **Washington, DC 20460** (phone: 703-557-4368).

1/27/86

LIST OF INTERIM REENTRY INTERVALS
ESTABLISHED IN REGISTRATIONS STANDARDS

Name of Pesticide	*Date of Issue*	*Data Required*	*Interim Interval*	*Toxic Effect*
1. Aldicarb	3/84	yes	24-hr	ChE (Tox. I)
2. Aliette	6/83	no	[a]	Teratogen
3. Aluminum Phosphide	10/81	yes	[b]	Acute Inhal.
4. Anilazine	12/83	yes	24-hr	Skin Irrit.
5. Aspon	9/80	yes	48-hr	ChE (Tox. I)
6. Captafol	8/84	yes	24-hr	Oncogen
7. Carbofuran	7/84	yes	24-hr [c]	Skin Irrit., ChE
8. Carbophenothion	5/84	yes	48-hr	ChE
9. Chlorobenzilate	12/83	yes	24-hr	Oncogen
10. Chloropicrin	9/82	no	[d]	Acute
11. Chlorothalonil	9/84	yes	24-hr [e]	Skin Irrit.
12. Chlorpyrifos	9/84	yes	24-hr [e]	ChE
13. Daminozide	6/84	yes	24-hr	Oncogen
14. Demeton	2/85	yes	48-hr	ChE
15. Dialifor	7/81	yes	75-days on grapes	Teratogen
16. Dicrotophos	6/82	no	48-hr [f]	ChE
17. Dimethoate	4/83	yes	4 days, citrus, grapes	Onco., Muta., & Terat.
18. Dioxathion	3/83	yes	24-hr	Acute Oral & Der. Tox. 1
19. Disulfoton	12/84	yes	24-hr	Acute Tox.
20. Ethion	12/82	yes	24-hr	ChE
21. Fensulfothion	12/83	yes	[g]	Tox. I Oral & Dermal
22. Fonofos	3/84	yes	24-hr	Tox. I
23. Formetanate Hydrochloride	9/83	yes	24-hr	Tox. I — Acute Oral and Eye Effects
24. Linuron	6/84	yes	24-hr	Potential Oncogen
25. Methidathion	1/83	yes	24-hr	Tox. I — Oral Tox. II — Dermal
26. Methamidophos	9/82	yes	24-hr	ChE
27. Methomyl	1/82	yes	48-hr	ChE
28. Monocrotophos	9/85	yes	48-hr	Acute Tox.
29. Naled	6/83	yes	24-hr	Tox. I inhal. & eye irr., Tox. II
30. Phorate	8/84	yes	24-hr	High Acute Tox.
31. Phosalone	8/81	no	24-hr	ChE
32. Sulfur	12/82	yes	24-hr	Low Tox.
33. Sulfuryl Fluoride	6/85	yes	[d]	Acute Inhal.
34. Thiram	6/84	yes	24-hr	
35. TPTH	9/84	yes	24-hr	Teratogen; pot. Oncogen; Tox. I
36. Trichlorfon	6/84	no	24-hr	Tox. II — oral; Tox. III — dermal

[a] In a separate action and after receipt of additional toxicology data, a 7-day reentry interval was imposed for use on hops based on a teratogenic effect. [b] Aeration of the structure/container required to the OSHA TWA. (The active principal, phosphine, is a gas.) [c] Also has a current 14-day reentry interval on seed corn. **[d]** OSHA Standard (TWA) applies — only present as a gas after application. [e] Protective clothing required for early reentry. [f] On ornamental and crop usage. **[g]** 7-day reentry interval when applied to soil and 24 hours for hand labor operations and foliar contact. The 7-day reentry interval is waived when applied to soil if workers are wearing impermeable footwear and impermeable gloves when hand contact with soil will occur. If soil is dry, the 7-day reentry interval is waived and the 24 hour interval will apply.

ChE = Cholinesterase inhibitor

Prepared by James D. Adams, TS-769-C, Hazard Evaluation Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460 (phone: 703-557-4368).